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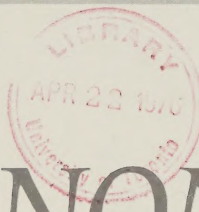
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# CANADIAN FARM ECONOMICS



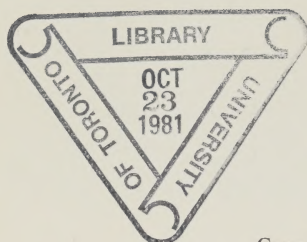
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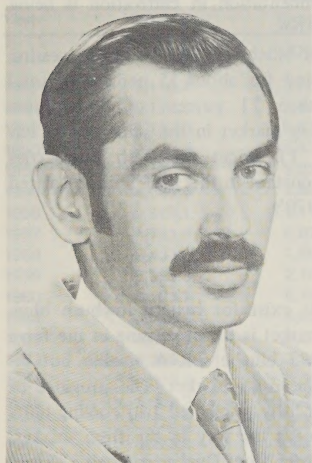
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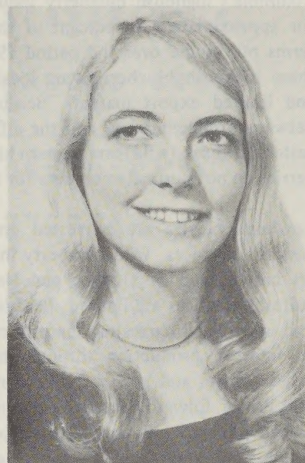
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# ATLANTIC LOWBUSH BLUEBERRIES



*Canadian blueberry production has been increasing in value and in 1975 reached an estimated 8 million dollars. Approximately 80 percent of the variation in the annual average grower price of Nova Scotia berries can be accounted for by three factors. They are: United States per capita blueberry stocks, Canadian per capita disposable income, and the State of Maine's per capita blueberry production.*

*R.W. Anderson and N.J. Teeter\**



## INTRODUCTION

The Canadian blueberry industry appears to have a promising future. Export markets historically concentrated in the United States, are expanding in Europe while production shows promise of increasing. With total returns to Canadian producers estimated at \$8 million in 1975, the blueberry industry is continuing to grow (Table 1). As a result, the industry is interested in what factors affect the price of their product and what can be expected in market expansion. This paper concentrates on the factors affecting prices for eastern blueberry producers and potential export markets for lowbush blueberries.

## PRODUCTION

Most of Canada's blueberry industry is located in eastern Canada where more than 80 percent of total production is supplied from wild or lowbush blueberries. In British Columbia, cultured or highbush blueberries are grown commercially. Total blueberry production reached a high of 37.5 million pounds in 1966, and then

**TABLE 1. CANADIAN BLUEBERRY PRODUCTION, PROCESSED, FROZEN, PRICES AND TOTAL VALUE**

| Year              | Total Pro-<br>duction | Volume Pro-<br>cessed | Volume <sup>a</sup><br>Frozen | East <sup>b</sup><br>Price | B.C. <sup>c</sup><br>Price | Total <sup>d</sup><br>Value |
|-------------------|-----------------------|-----------------------|-------------------------------|----------------------------|----------------------------|-----------------------------|
|                   | 000lbs                | 000lbs                | 000lbs                        | \$/unit                    | \$/unit                    | '000\$'s                    |
| 1960              | 19,605                | 5,991                 | 5,355                         | 4.56                       | 4.20                       | 2,383                       |
| 1961              | 18,063                | 7,851                 | 4,290                         | 4.50                       | 4.16                       | 1,823                       |
| 1962              | 18,226                | 7,446                 | 4,344                         | 4.64                       | 4.12                       | 1,821                       |
| 1963              | 23,954                | 7,220                 | 4,171                         | 3.93                       | 4.08                       | 2,795                       |
| 1964              | 20,861                | 7,314                 | 4,502                         | 5.16                       | 4.28                       | 3,603                       |
| 1965              | 18,145                | 9,100                 | 6,336                         | 5.57                       | 4.93                       | 4,406                       |
| 1966              | 37,509                | 16,066                | 12,287                        | 4.86                       | 5.04                       | 6,674                       |
| 1967              | 31,133                | 10,504                | 11,699                        | 5.15                       | 4.91                       | 3,428                       |
| 1968              | 15,781                | 6,919                 | 5,517                         | 5.72                       | 5.28                       | 3,055                       |
| 1969              | 28,700                | 13,767                | 11,760                        | 6.16                       | 5.74                       | 4,886                       |
| 1970              | 28,570                | 15,838                | 13,677                        | 5.83                       | 5.92                       | 6,136                       |
| 1971              | 22,471                | 13,717                | 9,739                         | 7.26                       | 6.59                       | 3,830                       |
| 1972              | 26,221                | 12,435                | 10,943                        | 7.48                       | 8.50                       | 7,009                       |
| 1973              | 36,013                | 20,551                | 15,421                        | 7.96                       | 7.52                       | 10,365                      |
| 1974              | 19,496                | 12,894                | 8,555                         | 8.86                       | 7.95                       | 3,946                       |
| 1975 <sup>e</sup> | 30,400                |                       |                               | 9.74                       | 8.42                       | 7,904                       |

<sup>a</sup>The volume frozen is included in the volume processed (available statistics for 1967 appear incorrect but no explanation available).

<sup>b</sup>Dollars per 11 quart unit. (wild lowbush blueberries).

<sup>c</sup>Dollars per 12 pint crates (cultured highbush blueberries).

<sup>d</sup>Fresh farm value, excluding Ontario.

<sup>e</sup>Preliminary estimates.

SOURCE: Statistics Canada.

\*R.W. Anderson and N.J. Teeter are economists in the Marketing and Trade Division, Horticulture and Special Crops Unit, Economics Branch, Agriculture Canada.

declined for a number of years until returning to a high of 36.0 million pounds in 1973 (Table 2). British Columbia's highbush blueberry industry has accounted for approximately 18 percent of the total industry in terms of volume over the period 1967-73. Markets for these highbush blueberries are local domestic markets and limited export markets. Because of the distance between producing areas and the difference in products eastern lowbush (wild) and western highbush (cultivated) berries do not normally compete for the same market.

Lowbush berries are harvested commercially in five eastern provinces. Wild blueberry industries are located on crown land in Quebec and Newfoundland where cultural practices are limited. Because the land is public and open to all harvesting teams there is little incentive to improve production through the use of fertilizer, weed control and sprays. Nova Scotia, New Brunswick and Prince Edward Island have commercial, privately-owned lowbush industries. Nova Scotia is normally the major production area. In some years, as a result of favorable weather conditions, good prices, and an adequate supply of pickers, Quebec production exceeds that of Nova Scotia (Table 2).

Production practices in Nova Scotia, New Brunswick and Prince Edward Island include burning, fertilizing, insect and weed spraying, and more recently, new variety breeding and planting. Burning to prune old bushes is organized and conducted on a rotational basis by

commercial growers. With the exception of new varieties, cultural practices are fairly uniform from grower to grower. Some experimentation in cultivation is being done on the new varieties.

Since 1970, lowbush blueberry sales to the processing market have accounted for about 55 percent of total production. More than 71 percent of the volume entering the processing market in the same period has been frozen (Table 1). Prices for fresh blueberries remained relatively constant in the 1960's but escalated significantly in the 1970's.

## DEMAND

Two distinct markets exist for eastern lowbush blueberries. The major market is for processing in the form of frozen and canned blueberries. A smaller but increasing market is the fresh market. The province of Quebec which has recently purchased two cooling units for the 1975 crop leads the way in the fresh market. Fresh packed blueberries from Quebec are being exported and sold in many Ontario and Quebec cities. Some fresh blueberries are sold at roadside stands in other provinces but the total volume is small.

Blueberry exports are a major outlet for the industry. Processed exports account for about 60 percent of total exports (Table 3). Most fresh and frozen exports are to the United States. However, frozen blueberry sales to Europe have increased since 1973 (Table 4). In terms of

**TABLE 2. CANADIAN BLUEBERRY PRODUCTION**

| Year              | Newfoundland | Prince Edward<br>Island | Nova<br>Scotia | New<br>Brunswick | Quebec | British<br>Columbia | Canada |
|-------------------|--------------|-------------------------|----------------|------------------|--------|---------------------|--------|
|                   |              |                         | ('000 lbs)     |                  |        |                     |        |
| 1960              | 2,814        | 130                     | 5,400          | 3,500            | 6,098  | 1,663               | 19,605 |
| 1961              | 2,934        | 451                     | 5,700          | 4,500            | 2,715  | 1,763               | 18,063 |
| 1962              | 1,250        | 238                     | 7,400          | 4,000            | 3,429  | 1,909               | 18,226 |
| 1963              | 1,400        | 1 150                   | 7,000          | 4,000            | 8,551  | 2,853               | 29,954 |
| 1964              | 1,036        | 200                     | 5,100          | 3,000            | 8,762  | 2,763               | 20,861 |
| 1965              | 2,264        | 250                     | 7,000          | 2,500            | 3,081  | 3,050               | 18,145 |
| 1966              | 2,361        | 550                     | 7,600          | 7,000            | 16,550 | 3,448               | 37,509 |
| 1967              | 1,690        | 710                     | 11,700         | 7,000            | 5,461  | 4,572               | 31,133 |
| 1968              | 568          | 450                     | 2,100          | 1,500            | 6,010  | 5,153               | 15,781 |
| 1969              | 795          | 1,400                   | 9,280          | 5,500            | 8,000  | 3,725               | 28,700 |
| 1970              | 3,000        | 5,000                   | 8,300          | 1,500            | 10,500 | 4,770               | 28,570 |
| 1971              | 1,700        | 525                     | 7,200          | 4,800            | 4,200  | 4,046               | 22,471 |
| 1972              | 2,100        | 177                     | 10,000         | 3,779            | 6,321  | 3,989               | 26,221 |
| 1973              | 2,596        | 1,000                   | 10,200         | 4,650            | 11,650 | 5,917               | 36,013 |
| 1974              | 662          | 700                     | 7,700          | 2,784            | 4,050  | 3,600               | 19,496 |
| 1975 <sup>a</sup> | 3,200        | 900                     | 9,000          | 4,300            | 7,500  | 5,500               | 30,400 |

<sup>a</sup>Preliminary estimate.

SOURCE: Statistics Canada.

TABLE 3. BLUEBERRY EXPORTS AND IMPORTS<sup>a</sup>

| Year       | Fresh<br>Exports | Frozen<br>Exports | Fresh<br>Imports |
|------------|------------------|-------------------|------------------|
| (‘000 lbs) |                  |                   |                  |
| 1950       | 7,110.7          | 3,757.7           | —                |
| 1951       | 20,122.1         | 2,416.9           | —                |
| 1952       | 15,725.0         | 5,835.0           | —                |
| 1953       | 9,939.3          | 3,430.2           | —                |
| 1954       | 22,190.4         | 3,034.7           | —                |
| 1955       | 14,345.4         | 2,580.2           | —                |
| 1956       | 9,818.1          | 1,140.1           | —                |
| 1957       | 4,733.5          | 6,621.7           | —                |
| 1958       | 8,433.8          | 1,965.7           | —                |
| 1959       | 8,355.8          | 2,168.7           | —                |
| 1960       | 8,203.7          | 6,163.7           | —                |
| 1961       | 4,450.9          | 5,552.0           | 1,180            |
| 1962       | 4,891.5          | 5,376.1           | 1,260            |
| 1963       | 9,349.3          | 7,262.9           | 977              |
| 1964       | 7,303.6          | 5,360.4           | 1,428            |
| 1965       | 5,662.2          | 5,431.3           | 1,928            |
| 1966       | 15,124.3         | 5,780.2           | 1,906            |
| 1967       | 8,223.9          | 13,878.9          | 1,909            |
| 1968       | 2,877.9          | 8,033.8           | 2,201            |
| 1969       | 4,205.1          | 9,153.2           | 2,871            |
| 1970       | 4,668.1          | 12,760.0          | 2,242            |
| 1971       | 4,001.5          | 7,438.0           | 3,269            |
| 1972       | 3,966.1          | 9,883.0           | 2,831            |
| 1973       | 5,357.3          | 12,489.4          | 3,360            |
| 1974       | 3,707.0          | 13,341.0          | 5,070            |

<sup>a</sup>Crop year.

SOURCE: Statistics Canada.

value, frozen blueberry exports have increased from \$2.2 to \$5.7 million between 1969 and 1974 (Table 4). West Germany, the Netherlands, Norway and Sweden purchased significant quantities of frozen blueberries in 1973 and 1974. Exports of both fresh and frozen blueberries as a percentage of total production showed a distinct increase in 1974 (Table 5) reflecting higher volumes of sales to Europe. Increased interest in Canadian lowbush blueberries by European countries stems from a decline in the Polish bilberry crop. (The Polish bilberry closely resembles wild blueberries).

Polish bilberries have until recently met European requirements<sup>1</sup>. In 1974, the bilberry crop failed due to poor weather. Over the longer run, a shortage of labor has led to smaller bilberry crops. Polish officials hope to convert to a cultured large berry crop eventually but for

<sup>1</sup> Ricks, Donald J. The Polish Bilberry Industry, Agricultural Economics Staff Paper No. 75-11, Department of Agricultural Economics, Michigan State University. April 1975.

TABLE 4. EXPORTS OF FROZEN BLUEBERRIES 1969-1975<sup>a</sup>

| Country        | 1969     |             |              | 1970     |             |              | 1971     |             |              | 1972     |             |              | 1973     |             |              | 1974     |             |              |
|----------------|----------|-------------|--------------|----------|-------------|--------------|----------|-------------|--------------|----------|-------------|--------------|----------|-------------|--------------|----------|-------------|--------------|
|                | Quantity | Total Value | Value Per lb | Quantity | Total Value | Value Per lb | Quantity | Total Value | Value Per lb | Quantity | Total Value | Value Per lb | Quantity | Total Value | Value Per lb | Quantity | Total Value | Value Per lb |
|                | 000lbs   | 000\$'s     | cents        | 000lbs   | 000\$'s     | cents        | 000lbs   | 000\$'s     | cents        | 000lbs   | 000\$'s     | cents        | 000lbs   | 000\$'s     | cents        | 000lbs   | 000\$'s     | cents        |
| United States  | 7,599    | 2,113       | 27.8         | 11,606   | 3,334       | 28.7         | 8,044    | 2,558       | 31.8         | 10,464   | 3,802       | 36.2         | 8,347    | 3,542       | 42.4         | 7,636    | 3,164       | 41.4         |
| Australia      | 32       | 10          | 31.3         | 28       | 7           | 25.0         | 27       | 8           | 29.6         | 39       | 13          | 33.3         | 6        | 3           | 50.0         | 20       | 7           | 35.0         |
| United Kingdom | 45       | 13          | 28.9         | —        | —           | —            | —        | —           | —            | —        | —           | —            | 36       | 17          | 47.2         | 192      | 85          | 44.3         |
| West Germany   | 115      | 33          | 28.7         | 441      | 126         | 28.6         | —        | —           | —            | —        | —           | —            | 90       | 47          | 52.2         | 2,188    | 934         | 42.7         |
| Netherlands    | —        | —           | —            | —        | —           | —            | —        | —           | —            | —        | —           | —            | 43       | 14          | 32.6         | 3,682    | 1,445       | 39.2         |
| Norway         | —        | —           | —            | —        | —           | —            | —        | —           | —            | —        | —           | —            | 500      | 235         | 47.0         | 84       | 36          | 42.9         |
| Sweden         | —        | —           | —            | —        | —           | —            | —        | —           | —            | —        | —           | —            | 2,027    | 940         | 46.4         | —        | —           | —            |
| Finland        | —        | —           | —            | —        | —           | —            | —        | —           | —            | —        | —           | —            | —        | —           | —            | 40       | 10          | 25.0         |
| Switzerland    | —        | —           | —            | —        | —           | —            | —        | —           | —            | —        | —           | —            | —        | —           | —            | 40       | 14          | 35.0         |
| Austria        | —        | —           | —            | —        | —           | —            | —        | —           | —            | —        | —           | —            | —        | —           | —            | —        | —           | —            |
| TOTAL          | —        | 2,169       | —            | —        | 3,467       | —            | —        | 2,566       | —            | —        | —           | —            | —        | 4,810       | —            | —        | —           | 5,695        |

<sup>a</sup>Calendar years.  
Source: Trade of Canada

**TABLE 5. CANADIAN BLUEBERRY EXPORTS AS PERCENTAGE OF TOTAL PRODUCTION**

| Year | Total Production | Exports <sup>a</sup><br>( '000 lbs.) | %    |
|------|------------------|--------------------------------------|------|
| 1960 | 19,605           | 14,367                               | 73.2 |
| 1961 | 18,063           | 10,003                               | 55.4 |
| 1962 | 18,226           | 10,268                               | 56.3 |
| 1963 | 29,954           | 16,612                               | 69.3 |
| 1964 | 20,861           | 12,664                               | 60.7 |
| 1965 | 18,145           | 11,094                               | 61.1 |
| 1966 | 37,509           | 20,905                               | 55.7 |
| 1967 | 31,133           | 22,103                               | 71.0 |
| 1968 | 15,781           | 10,912                               | 69.1 |
| 1969 | 28,700           | 13,358                               | 46.5 |
| 1970 | 28,570           | 17,428                               | 61.0 |
| 1971 | 22,471           | 11,440                               | 50.9 |
| 1972 | 26,221           | 13,849                               | 52.8 |
| 1973 | 36,013           | 17,847                               | 49.6 |
| 1974 | 19,496           | 17,048                               | 87.4 |

<sup>a</sup>Fresh and frozen

Source: derived from Statistics Canada data.

a few years will continue to harvest the declining bilberry crop. At the same time, the demand for frozen bilberries in Belgium and West Germany has been expanding as more refrigerators and freezers become available. The Canadian lowbush (wild) blueberry, although not as tart in flavor nor as dark in color as the bilberry, is a very similar product. Highbush (domestic) blueberries, although a competing product, are not as tart in flavor nor as darkly colored as either bilberries or wild blueberries. Bilberries are not used for bakery products as are blueberries in Canada, but are primarily used to make juices, wines, liqueurs and yogurt. Hence, both deep color and sharp flavor are very important. Major bilberry importers in West Germany and Belgium have expressed great interest in the wild lowbush Canadian blueberry as a substitute. American highbush blueberry producers are continuing their efforts to convince bilberry purchasers that highbush (domestic) blueberries are superior to lowbush (wild) blueberries. At least one highbush blueberry trade mission from Michigan has travelled throughout Europe since January 1975. In July, 1975 a Canadian mission from the Maritimes visited Holland, West Germany and Sweden.

The mission assessed the prospective demand and identified market trends. Members returned with an optimistic report on the prospects for sales. It is essential, however, that continual monitoring of the export and domestic markets be carried out and that supplies to Europe be consistent.

## EXPERIMENTAL WORK

In anticipation of increased demand both by the export sector and the domestic market, the question of how to bring about both increased production and consistent supply has arisen. Increased blueberry production will result from concentration on improvement of existing stands, from improved cultural practises and development of improved higher yielding clones. Federal and provincial research programs have been experimenting with new varieties and propagation programs. There are two methods of propagation. One is by seedlings and the other is by cuttings (true reproduction). The seedling method is used to make crosses which produce new clones. The new clones bear their fruit somewhat up off the ground which is better for mechanical harvesting. They can be propagated in inexpensive plastic greenhouses which have both a mist and a heating system. Superior clones have been collected throughout the Atlantic Provinces and from them, a new variety, "Me. 2", named Augusta<sup>2</sup> has been developed by the Agriculture Canada Research Station at Kentville. In greenhouses and small scale field plots this new variety has produced three to four times the average yield of native stands. On a commercial field basis, it is estimated that a reasonable level of production could be expected by the fifth year. With these clones a full technology package would include carefully selected soil, soil testing, fertilizer application and proper planting as well as improved handling to move the crop in good condition to processors.

Propagation by cuttings is also being explored. This involves developing a plant from cuttings taken from the original bush. Approximately 12 months under greenhouse production conditions are required to produce a new plant, if seed or cutting reproduction is used.

A major constraint to expanded production and consistent supply is harvest labor. Growers often experience difficulty in getting enough manpower to pick the crop. In years when the demand for blueberries is low, payment to pickers is reduced and fewer berries are harvested. An excellent example of this occurred in 1974, when poor prices, in addition to poor weather conditions, resulted in a 16.5 million pound decline in total production. At present, blueberries are harvested manually using a specially designed hand raker. Current conditions of rough terrain and bushes which bear fruit

<sup>2</sup>Dr. J. Wright, Director, and Dr. I. Hall, Agriculture Canada Research Station, Kentville, Nova Scotia.

close to the ground make hand harvesting with a rake the only viable method of reaping the crop. However, in planting new acreage of the Augusta variety (Me. 2) the ground must be levelled. This would be more conducive to mechanical harvesting. Nevertheless, labor will still be required for areas of rough terrain.

Research is at the stage where large scale field testing is required. Some grower cooperators have been identified but assistance is needed to help share the financial and risk burden. Federal and provincial assistance programs are under examination to determine what aid is available.

## INPUT AND CULTIVATION COSTS

Many costs are involved in the expansion and maintenance of blueberry acreage. These include land clearing, planting, input and cultivation costs plus forgone revenue while the bushes are maturing. Estimates of the actual costs involved are preliminary. For example, it is expected that the costs of clearing a field would vary between \$70 and \$110 per acre (average \$90)<sup>3</sup>. Approximately 10,000 plants per acre can be planted at \$.04 per plant. This would amount to \$400 per acre for new plants. Cultural costs per acre<sup>4</sup> are estimated at \$133. In total, planting and cultural expenses in the first year of cultivation could amount to \$623 per acre. In the second year the costs would not be as high since the costs of new plants have already been incurred and the land has been cleared. They might amount to \$133 a year<sup>5</sup>. In each year, however, revenue is forgone. At present, yields in Nova Scotia are estimated at approximately 1500 pounds per acre. Using the price received by producers in 1975, of 26 cents per pound, this would amount to a gross return of \$390 per acre a year for land which had previously been producing other older varieties. Subtracting cultural and harvesting costs, the net opportunity cost would be \$117 per acre a year. A solid stand of blueberries may be expected in the fifth year. In total, costs for the five-year waiting period could amount to about \$1,900 per acre. If present yields are tripled by the new Augusta variety (Me. 2) and the 1975 estimated grower price of \$.26 per pound is assumed, a gross return of \$1,170 a year could be expected in the fifth year. Total cultural and harvesting costs, once production has begun, could amount to \$273

per acre<sup>6</sup>. These estimates indicate that a break-even point may be reached in the seventh year after the initiation of the project.

There is a considerable number of acres of abandoned farmland in the Atlantic Provinces which are level, have suitable soil type, are well drained and show a fertility response conducive to blueberry production. In such cases it could take as long as two years to properly prepare the land for planting. This would involve higher costs than those involved in converting presently cultivated farm land and thus a longer waiting period to break even.

## FACTORS AFFECTING PRODUCER PRICES FOR FROZEN LOWBUSH BLUEBERRIES<sup>7</sup>

Producer and industry sources have stated that the price paid to producers for blueberries sold for processing is determined by blueberry conditions in the United States and particularly in the state of Maine. As Canada's season follows that of the United States, supplies and prices are established prior to the Canadian season in what has been the major export market for Canadian berries. Canadian processors must compete on the U.S. market as well as sustain transport costs higher than those of U.S. processors. U.S. and Canadian processors compete for producer berries in New Brunswick on a very extensive scale and on a limited scale in Nova Scotia.

Since most of Canada's exports are sold in the large U.S. market, U.S. blueberry production is expected to have a major impact on market prices. U.S. blueberry production, although dominated by highbush berries, includes significant quantities of lowbush berries. Although both high and lowbush berries are used for the same products in the U.S., Canadian lowbush berries are believed to compete more directly with lowbush berries from Maine. It is assumed that prices paid by processors for Canadian lowbush blueberries will be inversely related to total U.S. blueberry production and to blueberry production in Maine. Because of the similarity between Maine and Canadian lowbush blueberries and the location of the two major producing areas, it is anticipated that Maine production will have a greater impact on Canadian lowbush blueberry processing prices than will total U.S. production.

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<sup>3</sup> Quebec Department of Agriculture, 1973.

<sup>4</sup> Estimates prepared by Bob Murray and Jack Sibley, Small Fruit Specialists, Nova Scotia Department of Agriculture, 1974.

<sup>5</sup> Ibid.

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<sup>6</sup> Ibid.

<sup>7</sup> All factors are expressed in per capita terms.

An important factor in U.S. supply is inventory. As with production, inventory is inversely related to price. When inventories are high, prices are usually depressed. Blueberry stocks on July 1, prior to the major harvesting period, are expected to have the greatest impact.

Domestic supply conditions will have some impact on prices. Canadian production and stocks would have an inverse effect on prices. However, it is possible that Canadian supply factors will be insignificant because of the dominance of U.S. supply conditions.

Income, expressed as per capita disposable income, is a variable that may explain some of the price variation. Because blueberry products are dessert items and considered by many consumers as a luxury, prices are expected to vary directly with income.

Population is a factor affecting the demand for blueberries and hence their price. If per capita consumption remained constant, total demand would increase with population and would lead to increased blueberry prices.

Finally, a competing fruit such as cherries may affect the price of blueberries. Stocks of frozen tart red cherries in both the United States and Canada were used. If cherry stocks are high it is expected that cherry prices would be low, thus causing a decrease in blueberry prices.

Nova Scotia's producer price for blueberries sold for processing is considered to represent lowbush blueberry prices in Canada and to serve as the dependant variable in this analysis.

The quantifiable variables are represented by supply, income and competing fruit (described above). It is hypothesized that they account for much of the variation in the price of Canadian lowbush blueberries. The extent of their influence was estimated using ordinary least squares regression. Results from these estimates are reported below in one equation which numerically relates only the significant factors. Another equation using only Canadian data was considered but discarded.<sup>8</sup>

<sup>8</sup> The equation considered was the following:

$$\begin{aligned}
 &[(\log p) = 119.22 - 7.3799 (\log \text{ Canadian blueberry} \\
 &\quad (25.514) \quad (1.95127) \quad \text{stocks}) + \\
 &\quad 15.4586 (\log \text{ income}) - 3.0652 (\log \text{ Canadian} \\
 &\quad (3.19069) \quad (3.81827) \\
 &\quad \text{lowbush blueberry production})]
 \end{aligned}$$

The relationships in the discarded equation were consistent with those expected; however, Canadian blueberry production was not a significant factor in explaining variations in Canadian prices. Although both variables were significant, U.S. blueberry stocks, which are closely correlated (.89) with Canadian stocks, explained a greater percentage of the variation in price. Consequently, the equation using U.S. data has been retained. Log and non-log forms were used with the log form report below.

$$\begin{aligned}
 (\log P) = &1.8286 - 0.3326 (\log S) + 0.6493 \\
 &(2.1074) \quad (0.1490) \quad (0.2155)
 \end{aligned}$$

$$\begin{aligned}
 (\log Y) = &0.6056 (\log M) \\
 &(0.1764)
 \end{aligned}$$

$$\begin{aligned}
 R^2 = &.7964 & d = 1.843 \\
 d = &\text{Durbin-Watson Statistic}
 \end{aligned}$$

Standard errors are in parenthesis where:

P = price in cents per pound paid to Nova Scotia growers. (Table 6).

S = per capita stocks of frozen U.S. blueberries as of July (Table 6).

Y = Canadian per capita disposable income in actual dollars (Table 6).

M = per capita blueberry production in Maine (Table 6).

## CONCLUSIONS

Results indicate that the three variables, U.S. per capita blueberry stocks, Canadian per capita disposable income and per capita blueberry production in Maine, account for 79.6 percent of the variation in the annual average grower price of Nova Scotia blueberries<sup>9</sup>. Actual and estimated prices using this equation are presented in Table 7.

The meaning of this equation may be seen from the actual and estimated values, i.e., the value of P given when the equation above is calculated for actual values of S, Y and M values plotted in graphical form (Figure 1).

Maine production of blueberries proved to be a greater factor in explaining variations in price than total U.S.

<sup>9</sup> Prices in Nova Scotia and Maine are highly correlated (.95); therefore, Nova Scotia prices were used for analysis.

TABLE 6. DATA BLUEBERRY PRICE ANALYSIS, 1961-1974

|      | Producer Price<br>Nova Scotia<br>¢/lb. | U.S. Frozen<br>Blueberry Stocks<br>lb./capita | Canadian<br>Disposable Income<br>\$/capita | Maine<br>Blueberry Production<br>lb./capita |
|------|--|---|--|---|
| 1961 | 9.0                                    | 73.1  | 1,475                                      | 141.1                                       |
| 1962 | 8.5                                    | 70.6  | 1,579                                      | 164.8                                       |
| 1963 | 12.0                                   | 53.3  | 1,646                                      | 122.3                                       |
| 1964 | 15.0                                   | 35.0  | 1,713                                      | 115.6                                       |
| 1965 | 23.0                                   | 35.7  | 1,846                                      | 55.4  |
| 1966 | 15.5                                   | 42.4  | 1,994                                      | 100.0                                       |
| 1967 | 7.0                                    | 92.2  | 2,116                                      | 147.8                                       |
| 1968 | 17.0                                   | 99.5  | 2,262                                      | 69.2  |
| 1969 | 15.0                                   | 68.2  | 2,424                                      | 98.3  |
| 1970 | 21.0                                   | 82.4  | 2,535                                      | 45.4  |
| 1971 | 14.0                                   | 33.3  | 2,754                                      | 93.8  |
| 1972 | 24.0                                   | 38.6  | 3,044                                      | 82.0  |
| 1973 | 28.0                                   | 53.0  | 3,433                                      | 106.2                                       |
| 1974 | 20.0                                   | 97.1  | 3,919                                      | 87.6  |

Source: Sibley, J. "Lowbush Blueberry Production and Marketing in Nova Scotia, 1974, Nova Scotia Department of Agriculture.

Statistics Canada, "National Income and Expenditure Accounts", Cat. No. 13-001.

U.S.D.A., "Regional Cold Storage Holdings", Crop Reporting Board, Statistical Reporting Service, Cost (74)

blueberry production. U.S. stocks of blueberries are a significant factor while Canadian stocks and production have no significant effect on Nova Scotia prices. In light of the dependance of the Canadian industry on the U.S. market, these results are not surprising. They imply that under present market conditions Canadian production serves as a residual supply in the Canadian market. Disposable income is a significant factor as blueberry product sales respond to changes in income. Cherries, as a competing product, have no measurable effect on blueberry prices.

While this technique explains a proportion of the variation in prices, changing market conditions and the fact that not all of the variation was explained limits its use. By identifying and quantifying the key factors, industry marketing units can use estimates for each factor when available to give some indication of price trends in the longer term, a useful production planning tool but of restricted use in marketing strategies.

Increased sales to Europe will also affect the impact of the identified variables. As the European market expands and accounts for an increased percentage of the

total market, conditions in Europe will become important in determining the Canadian price.

TABLE 7. ACTUAL AND ESTIMATED PRICES PAID TO NOVA SCOTIA PRODUCERS FOR BLUEBERRIES SOLD FOR PROCESSING (CENTS PER LB.)

| Year | Nova Scotia<br>Producer<br>Price | Estimated<br>Producer<br>Price | Difference:                  |                          |
|------|----------------------------------|--------------------------------|------------------------------|--------------------------|
|      |                                  |                                | Actual<br>Minus<br>Estimated | Percentage<br>Difference |
|      |                                  | ¢/lb                           |                              | %                        |
| 1961 | 9.0                              | 7.7                            | 1.3                          | 14.8                     |
| 1962 | 8.5                              | 8.4                            | .15                          | 1.7                      |
| 1963 | 12.0                             | 11.4                           | .63                          | 5.2                      |
| 1964 | 15.0                             | 11.5                           | 3.5                          | 23.6                     |
| 1965 | 23.0                             | 13.2                           | 9.8                          | 42.5                     |
| 1966 | 15.5                             | 13.7                           | 1.8                          | 11.8                     |
| 1967 | 7.0                              | 12.1                           | (-) 5.1                      | (-) 73.4                 |
| 1968 | 17.0                             | 14.0                           | 3.0                          | 17.8                     |
| 1969 | 15.0                             | 16.2                           | (-) 1.2                      | (-) 8.2                  |
| 1970 | 21.0                             | 17.2                           | 3.8                          | 18.1                     |
| 1971 | 14.0                             | 20.4                           | (-) 6.4                      | (-) 45.8                 |
| 1972 | 24.0                             | 22.7                           | 1.3                          | 5.3                      |
| 1973 | 28.0                             | 25.1                           | 2.9                          | 10.3                     |
| 1974 | 20.0                             | 27.6                           | (-) 7.6                      | (-) 37.9                 |

# NOVA SCOTIA BLUEBERRIES: ACTUAL AND ESTIMATED PRICE RECEIVED BY GROWERS, 1961 - 1974

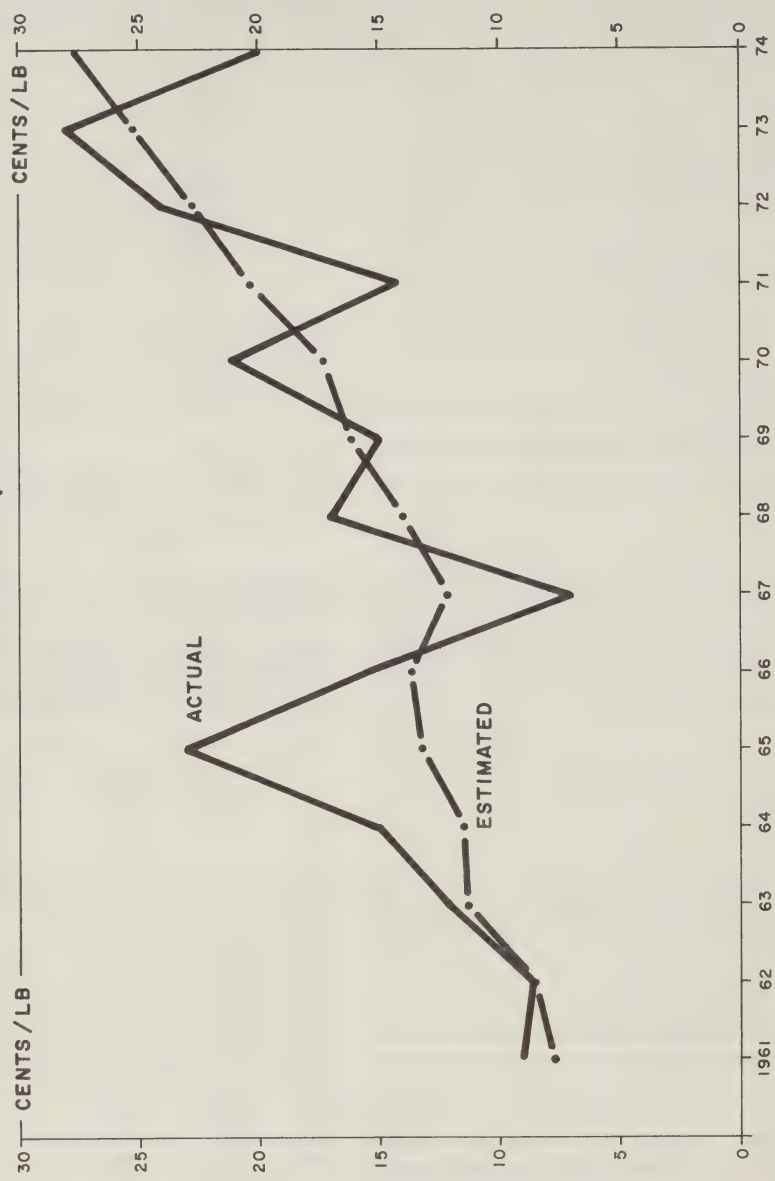


Figure 1

# AN INTRODUCTION TO THE AGRICULTURE-POPULATION LINKAGE PROGRAM



W.G. Freeman\*

*The program consists of a computerized record linkage of the 1971 Census of Agriculture and the 1971 Census of Population. The resulting linkage data base enables the cross-classification of agricultural characteristics of farming operations with socio-economic characteristics of farm operators and their households.*

## INTRODUCTION

Historically, knowledge of agriculture on a national scale has been largely limited to the agricultural characteristics of farming operations. The Census of Agriculture collects information, such as value of agricultural products sold, size of farm, type of farm and capital value. However, socio-economic data on Canada's farm population have remained incomplete. The Census of Agriculture collected some for the farm operator, namely the operator's age and days and kinds of off-farm work. Some socio-economic data on Canada's farm population (including operators) have been available from the Census of Population. However, the operators, their families and their households were not identifiable within this aggregated farm population<sup>1</sup>. Characteristics such as operator's occupation stated during census week, operators with zero farm income or a loss from farming, or percent of employment income from farming, especially when these are cross-classified

by a characteristic of farming operations, have not previously been available.

These data now exist for 1971 in the Agriculture-Population linkage program. The data enable researchers to tell a more complete story about the operators of Canada's census farms<sup>2</sup>, their families, and their households.

This article describes the methodology of the Agriculture-Population linkage program and some of the available data. The only research involved concerns the description of some observed relationships. The remainder of the article is broken down into "methodology", "examples of characteristics" and "user access".

## METHODOLOGY

The Agriculture-Population linkage program consists of a computerized record linkage of the 1971 Census of Agriculture and the 1971 Census of Population. The resulting linkage data base enables the cross-classification

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<sup>1</sup> All persons living in a dwelling situated on a census farm were considered to be farm population, regardless of their occupation.

<sup>2</sup> A census farm is an agricultural holding of at least one acre with sales of agricultural products during the preceding 12 months of \$50 or more.

of agricultural characteristics of farming operations with socio-economic characteristics of farm operators and their households.

The foundation of the program was relatively simple. The operator, or some member of the household of each census farm, completed two census questionnaires in 1971, the Agriculture and the Population questionnaire. The Agriculture questionnaire solicited information on the farming operation, such as agricultural sales and capital value for each census farm. The Population questionnaire requested socio-economic information about the operator and his household. A number of important stages of the program are summarized in the following sections.

### Match and Link

The Agriculture questionnaire for each census farm was matched by the computer to its corresponding Population questionnaire. The existence of unique identifying criteria (province, electoral district, enumeration area, and household number) for each farm operator household made this match possible. These criteria had been transcribed (during field collection and manual processing operations) to both questionnaires. The initial computer-run successfully matched 358,872 census farms (98 percent). Subsequent matches substituted the operator's age (which appeared on both questionnaires) for his household number. A further 7,187 census farms were thus, matched to their households. Finally, an imputation scheme matched the remaining 69 census farms.

A matched record pair, containing the identification criteria for the household, now existed for each census farm. The next step was to identify the operator from among other persons in each household. A computer search, using coding on the Population questionnaire and answers to specific questions from both questionnaires, identified each operator.

The matched record pair containing only the identification criteria for the household and operator for each census farm was "linked" into one record. These linked records were used to produce index files on which the remaining stages of the program depended. All response variables from both questionnaires were then accessible from the Agriculture and Population data bases by using index files in conjunction with a retrieval program.

### Weighting

A complexity was introduced into this otherwise simple start. Of the two kinds of Population questionnaires — a

long form and a short form, each household completed only one. The short form questionnaire was completed by approximately two thirds of all households.

The long form, which included the questions on the short form as well as questions related to such important characteristics as income, occupation stated during census week and level of schooling, was completed by approximately one third of the farm operator households.

Thus, in addition to a computer linkage of the Agriculture and Population questionnaires, there was the added complexity of calculating weights for census farms that linked to the long form (sample) Population questionnaires. Using the calculated weights, the characteristics of this sample would thus represent all census farms.<sup>3</sup> A selection of variables common to all linked records was retrieved (agricultural sales and capital value from Agriculture, and age and marital status from Population). These variables were used to cross-classify the population into groups by weighting areas (a census division or group of census divisions consisting of about 4,000 persons) for all persons in the total linked population and all persons in the sample. A ratio of the count in the total linked population to the count in the sample was calculated for each group.

Similarly, certain household variables common to the linked records were retrieved from the Population data base. These were: number of families in the household; sex and age of household head; number of persons in the household and number of rooms in the dwelling and tenure of dwelling. These variables were used to cross-classify the households into groups by weighting areas (one weighting area per province) for all farm operator households in the total linked population and all farm operator households in the sample. A ratio of the number of households in the total population to those in the sample was calculated for each group.

Two files, the household weight file (containing the weight for each household in the sample) and the population weight file (containing the weight for each person in the sample), were produced. The operators were identified on this file. The required elements to produce the Agriculture-Population linkage data base now existed.

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<sup>3</sup> The method used is known as the "Raking Ratio Estimation Procedure".

## Data Base

A selection of agricultural variables was retrieved for those records on the Agriculture data base that had been linked to the long form Population questionnaires (sample). These were stored on the Agriculture-Population linkage data base. Similarly, a selection of population variables was retrieved for the long form Population records (sample) from the Population data base that had been linked to census farms. These were stored on the newly created data base. Finally, the two files created in the "weight" stage containing the household and person weights were also transferred to the data base. The sample is thus weighted to represent the characteristics of the total population of persons and households.

The Agriculture-Population linkage data base consists of 130,410 linked records or 36 percent of the 1971 census farms. All relevant response variables that existed on the Agriculture and Population questionnaires were included. The number of farm operators, total persons and other factors, closely resembles the actual numbers. The retrieval of data from the base is accomplished by "Tarela-Statpak" — a user-orientated computer retrieval package.

## EXAMPLES OF CHARACTERISTICS

The Agriculture-Population linkage data base contains 250 response variables. This represents the majority of the questions from both the Census of Agriculture questionnaire and from the long form Census of Population questionnaire. A list of the frequently used characteristics is found in the appendix. Many of these characteristics are derived from more than one response variable. For example, the characteristic "level of schooling" uses "years of schooling", "vocational training" and six separate "university training" variables.

Examples of characteristics have been selected to describe some of the findings of the data. The article does not attempt to interpret any findings. Some do not offer anything new. They are presented as evidence of the validity and credibility of the data. The knowledge that expected relationships (based on theoretical and/or empirical evidence from other data sources) are observed in the linkage data base is valuable information for potential users of the data.

## Incomes

Five characteristics which have been selected to show the observed income relationships are discussed in the following sections.

## Economic Class of Farm

All census farms with the exception of institutional farms and community pastures, are classified on the basis of their sales of agricultural products. The economic class of farm is used as a rough indication of the economic well-being of the operator and his family. The linkage data suggest that this use of the characteristic can be misleading (Table 1). This is consistent with findings from the Agriculture Enumerative Survey<sup>4</sup>. The average total income of operators in the under \$2,500 economic class of farm is \$4,628. The average total income of operators' families is \$6,977.

**TABLE 1. ECONOMIC CLASS OF FARM AND AVERAGE INCOMES, CANADA, 1970**

| Economic Class    | Average Total <sup>a</sup><br>Income of<br>Operators | Average Net<br>Farm Income<br>of Operators | Average Total<br>Income of<br>Operators'<br>Families |
|-------------------|--|--|--|
|                   | \$   | \$   | \$   |
| TOTAL             | 4,893  | 1,683                                      | 6,928  |
| Under \$2,500     | 4,628  | 298  | 6,977  |
| \$2,500 - 4,900   | 3,874  | 1,002                                      | 5,924  |
| \$5,000 - 9,999   | 4,187  | 1,772                                      | 5,958  |
| \$10,000 - 24,999 | 5,416  | 2,852                                      | 7,150  |
| \$25,000 - 34,999 | 7,428  | 4,171                                      | 9,411  |
| \$35,000 - 49,999 | 7,868  | 4,321                                      | 9,931  |
| \$50,000 +        | 9,248  | 4,597                                      | 11,603   |

<sup>a</sup>Total income refers to aggregate income received in 1970 from wages and salaries, net non-farm or farm self-employment, family and youth allowances, government old age pensions, other government payments, retirement pensions from previous employment, bond and deposit interest and dividends, other investment sources and other sources.

These average incomes are higher than those for the next two higher economic classes. Only when the census farm is grossing \$10,000 or more, do the average total incomes exceed those in the under \$2,500 economic class. Nearly two thirds of Canada's census farms reported sales of agricultural products in 1970 worth less than \$10,000. The linkage data indicate little or no relationship between gross sales and total incomes for farm operators or their families. This conclusion holds true for Ontario and the four Western provinces. The Atlantic provinces and Quebec differ from the rest of Canada. There is a positive correlation between economic class of farm and total incomes of farm operators and families in these Eastern provinces.

<sup>4</sup>Refer to R.D. Bollman. "Off-Farm Work by Operators of Canadian Census Farms," Canadian Farm Economics, Number 6, December 1973.

**TABLE 2. VALUE OF FARM CAPITAL INVESTMENT AND AVERAGE INCOMES OF FARM OPERATORS, CANADA, 1970**

|                         | Value of Total Farm Capital Investment |                    |                     |                      |                       |                        |
|-------------------------|--|--------------------|---------------------|----------------------|-----------------------|------------------------|
|                         | Under<br>\$2,950                       | \$2,950 –<br>7,449 | \$7,450 –<br>19,949 | \$19,950 –<br>74,949 | \$74,950 –<br>149,949 | More than<br>\$149,950 |
|                         |  |                    |                     | – \$ –               |                       |                        |
| Average Total Income    | 3,625                                  | 3,672              | 3,928               | 4,602                | 5,513                 | 7,856                  |
| Average Net Farm Income | 387                                    | 467                | 703                 | 1,464                | 2,527                 | 3,460                  |

Table 1 also indicates average net farm incomes<sup>5</sup> for each economic class of farm. The difference between total income and net farm income is off-farm income. Off-farm income represents a greater proportion of total income to the operators of census farms in the lower economic classes.

### Type of Farm

With the exception of institutional farms and community pastures, all census farms with agricultural sales of \$2,500 or more in 1970 were classified on the basis of product type. The linkage data indicate that the operators of fruit and vegetable farms in Canada reported the highest average total incomes (\$6,814) in that year. The operators of poultry farms at \$6,265 were second, with dairy farms at \$5,624, being third. The operators of these three farm types tend to report the highest average total incomes in most provinces, although the ranking varies from one province to another. For instance, the operators of dairy farms in British Columbia report the highest average total income of all farm types in any province (\$10,147).

Net farm income data indicate that the operators of dairy farms in Canada reported the highest average net farm income in 1970 (\$3,651). The average net farm income of dairy farms in British Columbia was \$6,919, the highest average net farm income of any farm type in any province.

### Value of Farm Capital

The linkage data indicate that increasing levels of capitalization are associated with increasing income levels (Table 2). Net farm income increases from an average of \$387 for operators with less than \$2,950 farm

capital investment to an average of \$3,464 for those with farm capital investments exceeding \$149,950. Operators with larger farm capital investments also tend to report higher total incomes. The average total income for operators in the under \$2,950 farm capital investment range is \$3,625 compared with \$7,856 for operators in the \$149,950 or more farm capital investment range. There are, however, some unusual variations in the Atlantic provinces and Quebec. Operators in Newfoundland and New Brunswick report the highest average total income in the \$74,950 to \$149,949 farm capital investment range. Operators in New Brunswick, Nova Scotia, and Quebec report the highest average net farm income in the \$74,950 to \$149,949 farm capital investment range.

### Size of Farm (total acres)

The linkage data indicate that in Canada, operators of large farms are more likely to report higher net farm incomes than operators of small farms. On the other hand, farm size and total incomes for Canada or the provinces do not appear to be associated (Table 3). The average net farm income of operators on 1-to 9-acre farms is only \$614. This increases in every size of farm group to \$3,246 for the 1,600-acre farms. Similar trends are observed in all provinces except in Newfoundland, New Brunswick and Ontario. In these provinces the 760-to-1,599-acre farms and larger-than-1,600-acre farms report average net farm incomes that are smaller than the average net farm incomes in one or more smaller farm size groups.

### Level of Schooling

The attainment of higher levels of schooling is normally associated with higher incomes. The linkage data indicate that there is a positive direct relationship between the level of schooling and total income of operators (Table 4). This observed relationship is similar at both the provincial and national levels. The data indicate an inverse relationship between level of schooling and net farm income of operators.

<sup>5</sup> Net farm income refers to net self-employment farm income; i.e., the total receipts from farm sales less depreciation and operating expenses during 1970 as reported by the respondent.

TABLE 3. SIZE OF FARM (TOTAL ACRES) – AVERAGE INCOMES, CANADA, 1970

|                                    | Size of Farm (Total Acres) |       |        |         |           |         |
|------------------------------------|----------------------------|-------|--------|---------|-----------|---------|
|                                    | 1–9                        | 10–69 | 70–399 | 400–759 | 760–1,599 | 1,600 + |
|                                    | – \$ –                     |       |        |         |           |         |
| Operators' Average Total Income    | 5,927                      | 5,998 | 4,841  | 4,189   | 4,461     | 6,211   |
| Operators' Average Net Farm Income | 614                        | 896   | 1,625  | 1,781   | 2,269     | 3,246   |

TABLE 4. LEVEL OF SCHOOLING – AVERAGE INCOMES, CANADA, 1970

| Level of Schooling | Average Total Income of Farm Operators | Average Net Farm Income of Farm Operators |
|--------------------|--|---|
|                    | – \$ –                                 |   |
| Less than Grade 5  | 3,628                                  | 1,390                                     |
| Grades 5 to 8      | 4,617                                  | 1,835                                     |
| Grades 9 to 11     | 5,098                                  | 1,718                                     |
| Grades 12 to 13    | 5,726                                  | 1,404                                     |
| Some University    | 5,768                                  | 1,204                                     |
| University Degree  | 11,245                                 | –100                                      |

Selection of a Universe of Operators

Often researchers wish to analyze a selected universe of farm operators, families or households. For example, a researcher may want to examine only the characteristics of operators with significant net farm incomes. The retrieval package can, for instance, select only those operators with net farm incomes greater than 75 percent of the operator's total income. On the other hand, the researcher may want to add further constraints. He may be interested only in dairy farms with operators reporting "teacher" as their principal occupation. The flexibility of the retrieval package enables the researcher to define his own universe. He can then retrieve any combination of characteristics in tabular format to describe this universe.

The following example describes the characteristics of a selected universe of farm operators. One quarter of the operators<sup>6</sup> of census farms in 1971 stated an occupation other than farmer or farm manager.

<sup>6</sup> An operator is the person responsible for the day-to-day decisions made in running a census farm, whether as an owner, tenant or hired manager. As only one person was listed for each farm holding, the number of operators is the same as the number of census farms. Where the holding was operated by more than one person, as in the case of a partnership, only one of them was regarded as the operator.

This universe of operators reporting "other occupations" represents those operators of census farms in 1971 who reported that farmer or farm manager was not their principal occupation. This is not to suggest that they are not farming. In fact many apparently operate large-scale farms by any definition. They do however, represent an interesting group of multi-job-holding operators who, for census purposes at least, regard their "other occupations" to be more important during the week prior to the census date. The linkage data indicate the following information about this selected universe.

Significance

There were 98,230 operators reporting "other occupations" in Canada in 1971. This represents 26 percent of all census farms. Of the remainder, 237,895 reported their occupation as farmer or farm manager and 30,305 did not state any occupation. The occupation reported by the operator refers to that stated during census week. It refers to the kind of work the person was doing. Data relate to 'he job at which the respondent worked most hours (if employed at more than one job). If the person was not employed during enumeration week, the data relate to the job of longest duration since January 1, 1970.

Regional Distribution

Operators reporting "other occupations" are distributed differently on a provincial basis than those reporting "farmer and farm manager" (Table 5). In Ontario, a significant number of operators reported "other occupations". In Saskatchewan, on the other hand, operators reporting "farmer and farm manager" are significantly more important. In British Columbia the number of operators reporting "other occupations" outnumbers those reporting "farmer and farm manager".

**TABLE 5. REGIONAL DISTRIBUTION OF FARM OPERATORS STATING OTHER OCCUPATIONS AND OPERATORS STATING FARMER OR FARM MANAGER, CANADA AND PROVINCES, 1971**

|                      | Other Occupations |         | Farmer & Farm Manager |         |
|----------------------|-------------------|---------|-----------------------|---------|
|                      | Count             | Percent | Count                 | Percent |
| Canada <sup>a</sup>  | 98,230            | 100     | 237,895               | 100     |
| Newfoundland         | 475               | 1       | 325                   | 1       |
| Prince Edward Island |                   |         |                       |         |
| Island               | 1,280             | 1       | 2,740                 | 1       |
| Nova Scotia          | 2,535             | 2       | 2,755                 | 1       |
| New Brunswick        | 2,220             | 2       | 2,600                 | 1       |
| Quebec               | 15,560            | 16      | 36,890                | 15      |
| Ontario              | 32,380            | 33      | 54,290                | 23      |
| Manitoba             | 7,470             | 8       | 25,695                | 11      |
| Saskatchewan         | 12,725            | 13      | 60,935                | 26      |
| Alberta              | 14,935            | 15      | 44,485                | 19      |
| British Columbia     | 8,650             | 9       | 7,175                 | 3       |

<sup>a</sup>Includes Yukon and Northwest Territories.

## Incomes

The average total income in Canada of the "other occupations" group was \$6,298, whereas the average total income of the farm operators reporting their occupation as farmer or farm manager was \$4,406. Net farm income contributes a small proportion (2%) to the average total incomes of the "other occupations" group of Canadian farm operators. The linkage data indicate a similar trend in all provinces. On the other hand, in the "farmer and farm manager" group average net farm income represents 54 percent of the average total income.

## Ages and Incomes

Operators in the 35 to 44 age range reported the highest total incomes in both groups in Canada. Operators in the "other occupations" group reported an average of \$6,939, whereas operators in the "farmer and farm manager" group reported an average of \$5,104. There are provincial exceptions to this national observation. The highest average total incomes for the "farmer and farm manager" group are reported in the 45 to 54 age range for Newfoundland, Prince Edward Island, and Nova Scotia. The "other occupations" group of farm operators reported the highest average incomes in the 45 to 54 age range in Prince Edward Island, Ontario, Alberta and British Columbia. Two provinces, Nova Scotia and New Brunswick, reported the highest average total incomes for the "other occupations" group in the 25 to 34 age range.

## Economic Class of Farm

The "other occupations" group of operators is heavily concentrated in the under \$2,500 class, with 56 percent of all operators falling into this class. In the "farmer or farm manager" group only 16 percent of operators report sales of less than \$2,500 (Table 6).

**TABLE 6. OPERATORS BY ECONOMIC CLASS — "OTHER OCCUPATIONS" AND "FARMER & FARM MANAGER", CANADA, 1971**

| Economic Class  | Other Occupations |         | Farmer & Farm Manager |         |
|-----------------|-------------------|---------|-----------------------|---------|
|                 | Count             | Percent | Count                 | Percent |
| TOTAL           | 98,230            | 100     | 237,895               | 100     |
| Under — \$2,500 | 55,215            | 56      | 37,260                | 16      |
| 2,500 — 4,999   | 18,100            | 18      | 39,260                | 16      |
| 5,000 — 9,999   | 13,895            | 14      | 63,725                | 27      |
| 10,000 +        | 11,025            | 12      | 97,645                | 41      |

## Level of Schooling

The distribution by level of schooling shows no significant differences between the two groups discussed except for those operators with university degrees (Table 7). In the "other occupations" group the 3,130 operators with a university degree had an average total income in 1970 of \$14,194. Only 1,720 farmers and farm managers reported university degrees. Their average total income was only \$6,163.

**TABLE 7. OPERATORS BY LEVEL OF SCHOOLING, "OTHER OCCUPATIONS" AND "FARMER & FARM MANAGER", CANADA, 1971**

| Level of Schooling | Other Occupations |         | Farmer & Farm Manager |         |
|--------------------|-------------------|---------|-----------------------|---------|
|                    | Count             | Percent | Count                 | Percent |
| TOTAL              | 98,230            | 100     | 237,895               | 100     |
| Less than Grade 5  | 6,135             | 6       | 18,990                | 8       |
| Grades 5 to 8      | 44,665            | 45      | 123,365               | 52      |
| Grades 9 to 11     | 29,790            | 30      | 68,725                | 29      |
| Grades 12 to 13    | 11,230            | 11      | 18,960                | 8       |
| Some University    | 3,275             | 3       | 6,140                 | 2       |
| University Degree  | 3,130             | 3       | 1,720                 | 1       |

## Kinds of Occupations

All kinds of occupations were reported by the "other occupations" group of farm operators. The dominant categories were: construction trades (17,500); other manual (44,880); sales and clerical (11,475); service

(6,425); primary<sup>7</sup> (8,815); managerial (3,740); and professional (5,395); totalling 98,230.

## Poverty Farms

Another significant contribution of the linkage is that it can assist in describing the agricultural characteristics and geographical location of farms where the level of living of the farm family is below any defined poverty line. Policy makers have, historically, been at a disadvantage when constructing programs designed at improving total incomes for needy farm families because they are not easily identified, nor has the magnitude of the numbers been understood.

## SUMMARY

The Agriculture-Population linkage data base offers a wide variety of socio-economic data cross-classified by agricultural characteristics. These highlights represent an extremely modest selection of what is offered. The following discussion on "user access" explains how to obtain further information.

## USER ACCESS

The user has access to the data from the Agriculture-Population linkage program in two principal ways. One is through statistical reports and the other is through special user requests. The planning and development began some years prior to the 1971 census. Consultation with potential users was an important element in this development.

## Statistical Reports

There are seven available reports. The lowest geographic breakdown is for the provinces. The following is the complete listing.

- **Farm Operators by Economic Class Showing Such Characteristics as Sex, Age, Income, Schooling, Off-Farm Employment, Canada and Provinces, 1971.** Catalogue 96-734. The user is given a representative selection of the data potential of the linkage program.
- **Basic Socio-Economic Characteristics of Farm Operators, Canada and Provinces, 1971.** Catalogue 96-712 - Volume IV (Part 4) Report 4.4-1. Each table displays one socio-economic characteristic of the operator with economic class of farm or type of farm.

- **Cross-Classified Socio-Economic Characteristics of Farm Operators, Canada and Provinces, 1971.** Catalogue 96-713 - Volume IV (Part 4) Report 4.4-2. The tables display a selection of two or more socio-economic characteristics for farm operators with type of farm, economic class of farm, value of farm capital, and size of farm or tenure.

- **Cross-Classified Socio-Economic Characteristics of Farm Operators with Off-Farm Employment and Income, Canada, Provinces and Regions, 1971.** Catalogue 96-714 - Volume IV (Part 4) Report 4.4-3. The tables contain off-farm employment income and days of off-farm work with one or two socio-economic and/or farming characteristics. The report enables users to explore the subject of part-time farming in depth. The census has not defined part-time farms or farmers but has rather cross-classified two demarcating characteristics so that users can choose their own definition.

- **Cross-Classified Socio-Economic Characteristics of Farm Operators' Families, Canada and Provinces, 1971.** Catalogue 96-715 - Volume IV (Part 5) Report 4.5-1. Seven tables display characteristics of the operator and his family and one table displays characteristics of the operator and persons in the family.

- **Cross-Classified Socio-Economic Characteristics of Farm Operators' Households, Canada and Provinces, 1971.** Catalogue 96-716 - Volume IV (Part 5) Report 4.5-2. Three tables display characteristics of the operator and his household and five display characteristics of the operator and persons in the household.

- **Cross-Classified Socio-Economic Characteristics of Farm Operators' Household Dwelling Facilities, Canada, and Provinces, 1971.** Catalogue 96-717 - Volume IV (Part 5) Report 4.5-3. The tables cross-classify operators' household head status, residence location and total income of household head by one or more dwelling facilities' characteristics (e.g., principal heating equipment and fuel).

## Special User Requests

Although these seven bulletins contain a wide range of valuable data, many users have found the need for additional tabulations to suit their individual research needs, particularly for geographical areas smaller than provinces or regions. A special request program does exist. Through the computer retrieval package, user

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<sup>7</sup>Excluding farmers and farm managers.

tabulation requests are serviced in a matter of days. Users pay the cost of the actual computer charges plus overhead. Estimates are available upon request.

## APPENDIX

### Agriculture-Population Linkage Characteristics

1. Age
2. Average Cumulative Schooling of Family Members
3. Class of Worker
4. Completion of Vocational Course
5. Crops Reported
6. Days of Off-farm Work
7. Economic Class of Farm
8. Family Membership
9. Full and Part-time Work
10. Household Facilities
11. Household Head Status
12. Incidence of All Income Sources
13. Industry Divisions
14. Labor Force Activity
15. Level of Schooling
16. Level of Schooling of Family Head
17. Livestock and Poultry Reported
18. Location of Farm
19. Machinery Reported
20. Major Source of Family Income
21. Major Source of Household Income
22. Major Source of Income
23. Net Self-employment farm income
24. Number of Automobiles per Household
25. Number of Income Earners by Number of Income Recipients
26. Number of Months Residing on Farm Holding
27. Number of Moves Since June 1, 1966
28. Number of Persons per Room
29. Number of Rooms per Dwelling
30. Number of Year-round Workers
31. Occupation Stated During Census Week
32. Occupation — Work Experience
33. Off-farm Employment Income
34. Off-farm Occupation Reported
35. Operator's (Family) Head Status
36. Operator's Household Head Status
37. Operator's Total Employment Income
38. Per capita Family Income
39. Percent of Total Employment Income from Farming
40. Percent of Total Family Income Contributed by the Operator
41. Percent of Total Family Income from Farming
42. Percent of Total Household Income Contributed by the Operator
43. Percent of Total Household Income from Farming
44. Percent of Total Income from Farming
45. Percent of Total Income from Off-farm Employment
46. Percent of Total Land Improved
47. Percent of Total Land Irrigated, 1970
48. Period of Immigration
49. Place of Residence, June 1, 1966
50. Principal Heating Equipment by Fuel
51. Relationship to Family Head
52. Relationship to Household Head
53. Relationship to Operator
54. Residence Location
55. Sex
56. Size of Family
57. Size of Farm
58. Size of Household
59. Sources of Employment Income
60. Tenure
61. Tenure of Dwelling
62. Toilet Facilities
63. Total and Average Employment Income
64. Total Employment Income
65. Total Family Income
66. Total Household Income
67. Total Income
68. Total Income from Farming
69. Total Income of the Household Head
70. Total Value of Selected Expenditures
71. Type of Dwelling
72. Type of Family
73. Type of Farm
74. Type of Farm Organization
75. Type of Household
76. Type of Selected Expenditures
77. Usual Hours Worked
78. Usual Place of Work
79. Value of Kinds of Agricultural Products Sold
80. Value of Farm Capital (\$100)
81. Value of Total Farm Capital
82. Wages and Salaries
83. Wages and Salaries plus Non-farm Self-employment Income
84. Water Supply
85. Weeks Worked

# TRENDS IN FOOD CONSUMPTION, PRICES AND EXPENDITURES, 1961 - 73



D.T. Karamchandani\*

*Between 1961 and 1973, Canadian consumption of plant products increased 7.6 percent and that of animal products decreased 4.5 percent. Prices of animal products increased at a greater rate than prices of plant products, suggesting an inverse relationship between food consumption and changes in price.*

*Per capita food consumption as a whole was virtually unchanged in 1973 compared with 1961.*

*Food prices increased 88.4 percent but the share of income devoted to food dropped from 21.6 percent in 1961 to 18.8 percent in 1974. Disposable income increased 227.5 percent.*

## INTRODUCTION

The objective of this article is to examine changes that have occurred in food consumption, prices and expenditures from 1961 to 1973, and to show the extent to which prices and consumption are related. Expenditures for food and non-foods are examined in relation to changes in disposable personal income. The article also takes into account population growth and its impact on total food consumption.

In this paper, food commodities are grouped into two categories: plant products<sup>1</sup> and animal products<sup>2</sup>. Consumption data are expressed in terms of the retail weight or its equivalent. Price indexes, disposable personal income and expenditures are expressed in terms of the 1961 base (=100). Consumption and disposable income are expressed on a per capita basis. Population figures

are those of July 1 each year. Unless stated otherwise, 1973 data are compared with 1961 data to show the changes over the 1961-73 period.

## TRENDS IN FOOD CONSUMPTION

Except for potatoes, eggs and dairy products (Particularly fluid milk), most food commodities recorded consumption increases between 1961 and 1973 (Table 1). Consumption of animal products decreased 4.5 percent (from 626.3 to 598.1 pounds) while that of plant products increased 7.6 percent (from 820.4 to 882.9 pounds) (Figure 1). Fluid milk and eggs, whose consumption fell from 332.3 to 274.5 pounds and from 33.9 to 29.2 pounds, respectively (Table 1), largely accounted for the decline in consumption of animal products.

### Plant Products

Over the period, fruit consumption increased 18.2 percent, from 172.7 to 204.2 pounds, while vegetable consumption increased only 1.6 percent, from 114.0 to 115.8 pounds (Figure 2). Fresh fruits and juices accounted for most of the increase in fruit consumption. With the exception of the 1962-66 periods, sugar consumption rose rather steadily from 104.8 to 117.4 pounds, or 12.1 percent (Figure 3). Beverage consumption fluctuated from 1961 until 1969 when it began to increase steadily reaching 15.3 pounds in 1972 and 1973.

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<sup>1</sup>Includes: fruits, vegetables, drinks, oils and fats (excluding butter), cereals, sugars and syrups, pulse and nuts.

<sup>2</sup>Includes: meat, fish, poultry, eggs, dairy products and lard.

TABLE 1. PER CAPITA CONSUMPTION OF FOOD, CANADA, 1961-1973

| Commodity                   | 1961    | 1962    | 1963    | 1964    | 1965    | 1966    | 1967       | 1968    | 1969    | 1970    | 1971    | 1972    | 1973    |
|-----------------------------|---------|---------|---------|---------|---------|---------|------------|---------|---------|---------|---------|---------|---------|
|                             |         |         |         |         |         |         | — pounds — |         |         |         |         |         |         |
| Cereals <sup>a</sup>        | 152.2   | 150.2   | 156.9   | 145.3   | 163.4   | 150.1   | 149.6      | 149.3   | 153.3   | 152.2   | 145.7   | 152.7   | 151.4   |
| Sugar & Syrups <sup>a</sup> | 104.8   | 109.1   | 105.7   | 107.7   | 108.9   | 112.9   | 109.4      | 111.3   | 110.6   | 111.9   | 111.0   | 112.6   | 117.4   |
| Pulse & Nuts <sup>a</sup>   | 17.0    | 16.9    | 16.7    | 19.1    | 17.5    | 17.9    | 15.6       | 15.5    | 15.0    | 16.3    | 19.5    | 18.9    | 15.9    |
| Oils & Fats <sup>a</sup>    | 30.9    | 31.2    | 30.8    | 30.8    | 30.0    | 35.1    | 36.3       | 37.2    | 38.5    | 38.2    | 38.4    | 40.6    | 41.0    |
| Fruits <sup>b</sup>         | 172.7   | 169.5   | 174.8   | 180.6   | 182.2   | 187.8   | 194.9      | 188.1   | 192.2   | 184.7   | 192.0   | 192.0   | 204.2   |
| Vegetables <sup>b</sup>     | 114.0   | 114.9   | 104.6   | 105.4   | 113.4   | 116.4   | 115.9      | 117.6   | 110.6   | 119.0   | 114.6   | 110.0   | 115.8   |
| Tomatoes <sup>b</sup>       | 58.6    | 59.6    | 61.2    | 53.8    | 60.9    | 54.9    | 59.6       | 60.5    | 53.1    | 60.0    | 61.5    | 55.8    | 67.1    |
| Mushrooms <sup>b</sup>      | —       | —       | —       | —       | —       | —       | —          | —       | 2.0     | 2.1     | 2.9     | 3.8     | 4.1     |
| Potatoes <sup>b</sup>       | 164.4   | 160.8   | 154.8   | 157.5   | 156.4   | 178.0   | 170.7      | 170.6   | 160.3   | 156.3   | 151.5   | 160.2   | 157.5   |
| Red Meat <sup>c</sup>       | 139.9   | 140.6   | 143.9   | 150.2   | 150.4   | 149.6   | 157.5      | 158.7   | 155.5   | 160.4   | 169.9   | 165.8   | 159.8   |
| Poultry <sup>d</sup>        | 31.0    | 31.0    | 32.9    | 35.2    | 36.6    | 39.3    | 40.7       | 39.8    | 43.1    | 45.1    | 44.5    | 45.5    | 46.8    |
| Fish <sup>e</sup>           | 12.3    | 11.7    | 14.3    | 12.9    | 13.0    | 12.9    | 11.5       | 12.2    | 12.6    | 12.0    | 11.4    | 13.5    | 13.1    |
| Eggs <sup>b</sup>           | 33.9    | 33.7    | 32.2    | 32.0    | 31.7    | 30.7    | 31.3       | 31.4    | 32.1    | 32.5    | 32.0    | 30.82   | 29.2    |
| Dairy Products <sup>a</sup> | 400.7   | 395.8   | 395.9   | 394.4   | 389.8   | 385.1   | 374.8      | 366.3   | 360.5   | 343.9   | 341.0   | 342.7   | 342.5   |
| Beverages <sup>f</sup>      | 14.3    | 14.2    | 15.0    | 14.0    | 14.3    | 13.1    | 14.8       | 15.1    | 14.1    | 14.6    | 14.9    | 15.3    | 15.3    |
| Food Consumption - Total    | 1,446.6 | 1,439.4 | 1,439.6 | 1,438.9 | 1,468.4 | 1,483.8 | 1,482.6    | 1,473.6 | 1,453.5 | 1,449.1 | 1,450.8 | 1,460.2 | 1,481.1 |

<sup>a</sup>Retail weight.<sup>b</sup>Fresh equivalent weight.<sup>c</sup>Carcass weight.<sup>d</sup>Eviscerated weight.<sup>e</sup>Edible weight.<sup>f</sup>Tree leaf equivalent and green bean equivalent.

Source: Statistics Canada, Apparent per capita domestic disappearance of food in Canada, Cat. 32-226.

Oils and fats consumption remained at practically the same level between 1961 and 1964 but then jumped 50.4 percent from 22.8 to 34.3 pounds (Figure 4). This increase is mostly attributable to cooking oil, whose consumption has more than doubled since 1961, and to vegetable oil which recorded a 90.3 percent increase. Margarine consumption has been very stable at about 10 pounds while butter consumption dropped from 16.5 to 13.6 pounds (17.6 percent).

There has been considerable fluctuation in pulse and nuts consumption, an increase always followed by a decrease; for example, between 1969 and 1971, consumption rose 30 percent from 15.0 to 19.5 pounds and dropped to 15.9 pounds in 1973, a decline of 18.4 percent.

Cereal consumption was unstable until 1966, then stabilized up to 1973 with the result that consumption in 1973 was almost identical to that in 1961. This steadiness was also found for wheat flour, rye flour and meal, pearl barley, buckwheat flour and breakfast cereals. Rice, cornflour and meal showed substantial increases, 66.0 and 205.6 percent, respectively.

Tomato consumption, particularly pulp, paste and purée, fluctuated while potato consumption steadily declined despite a jump from 156.4 to 178.0 pounds from 1965 to 1966 (Figure 5).

### **Animal Products**

A comparison of meat, fish and poultry reveals that poultry consumption increased at the highest rate, 51 percent, from 31 to 46.8 pounds. Chicken and turkey recorded the largest increases while duck and goose remained at almost the same level. Beef consumption rose 29 percent from 71.1 to 91.8 pounds. Pork rose 14.5 percent from 50.3 to 57.6 pounds (between 1966 and 1971, pork consumption jumped 21.3 pounds but since then, seems to be declining). Veal declined 54.4 percent from 6.8 to 3.1 pounds. Consumption of mutton, lamb and edible meat by-products followed the same trend. In the fish category, consumption of molluscs and fresh and frozen shellfish is increasing, while that of smoked, cured and salted fish is declining each year. From 1971 to 1972, canned molluscs and shellfish recorded their only notable increase, from 3.8 to 5.2 pounds. Generally speaking, consumption of these products remained constant between 1961 and 1973.

Beef is still the favorite with a consumption of 91.8 pounds. It is followed by pork at 57.6, chicken 36.1,

turkey 10.2, fresh and frozen molluscs and shellfish 9.0, mutton and lamb 3.7, edible meat by-products 3.6 and veal 3.1 pounds.

Dairy products and eggs both trended downward (Figure 7). Fluid milk and butter consumption were largely responsible for the decline in consumption of dairy products (from 401 to 342 pounds). This trend was somewhat offset by cheese consumption, which increased from 7.5 to 14.4 pounds. Although egg consumption rose 1.7 pounds between 1966 and 1970, the trend shows a decrease of 14 percent over the 1961-1973 period.

## **TRENDS IN CONSUMER PRICE INDEXES**

This section examines changes in the price index in order to determine the relationship between prices and consumption.

### **Animal Products**

Generally speaking, there has been a much larger increase in the price index for animal products than for plant products (Table 2), especially for fish and meat, which recorded increases of 122.3 and 81.3 percent, respectively. Eggs were the most notable exception. Between 1961 and 1972, the price index remained fairly stable, ranging between 100 and 94.7 while in 1973 it climbed to 136.5.

Dairy products recorded a steady increase in prices, as did poultry during the period up to 1971. However, between 1971 and 1973, the poultry price index increased very sharply from 108.9 to 164.3

### **Plant Products**

The price index of oils and fats has remained the most stable. The increase in the prices of fruits, vegetables and sugars was slight from 1961 to 1971 and became sharp up to 1973.

Vegetables recorded larger price increases than fruits with the exception of raisins, apples and grapefruit (Table 3). The price index for bananas is declining.

The following briefly summarizes the discussion thus far:

## **INCREASE IN CONSUMPTION**

- Larger for plant products than for animal products
- Larger for fruits than for vegetables

**TABLE 2. PRICE INDEXES OF ANIMAL AND PLANT PRODUCTS, 1961-1973 (1961 = 100)**

| Item                       | 1961  | 1962  | 1963  | 1964  | 1965  | 1966  | 1967  | 1968  | 1969  | 1970  | 1971  | 1972  | 1973  |
|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| <b>Plant Products</b>      |       |       |       |       |       |       |       |       |       |       |       |       |       |
| Fruits & Vegetables        | 100.0 | 103.9 | 109.6 | 113.0 | 116.8 | 117.0 | 116.2 | 128.2 | 125.3 | 126.8 | 130.5 | 139.8 | 166.7 |
| Cereal & Bakery Products   | 100.0 | 102.2 | 107.1 | 112.1 | 112.7 | 115.7 | 117.4 | 120.0 | 121.5 | 124.1 | 121.9 | 131.3 | 143.9 |
| Sugar                      | 100.0 | 99.7  | 163.9 | 147.5 | 102.9 | 99.6  | 97.6  | 98.6  | 113.0 | 117.2 | 126.2 | 159.8 | 165.9 |
| Fats and Oils <sup>a</sup> | 100.0 | 98.3  | 96.4  | 99.0  | 108.2 | 113.2 | 110.9 | 107.0 | 105.6 | 110.6 | 112.6 | 113.8 | 119.9 |
| <b>Animal Products</b>     |       |       |       |       |       |       |       |       |       |       |       |       |       |
| Red Meat                   | 100.0 | 106.3 | 105.2 | 102.6 | 108.8 | 122.3 | 121.5 | 122.4 | 133.2 | 135.8 | 131.2 | 147.5 | 181.3 |
| Fish                       | 100.0 | 102.6 | 105.0 | 106.0 | 111.1 | 122.0 | 124.4 | 127.0 | 136.0 | 150.6 | 157.0 | 180.5 | 222.3 |
| Poultry                    | 100.0 | 102.3 | 104.9 | 100.0 | 102.9 | 111.0 | 106.6 | 109.6 | 109.2 | 105.8 | 108.9 | 124.6 | 164.3 |
| Dairy Products             | 100.0 | 97.3  | 97.0  | 99.8  | 102.5 | 109.7 | 117.0 | 121.5 | 125.9 | 127.0 | 131.9 | 139.1 | 149.5 |
| Eggs                       | 100.0 | 94.6  | 103.7 | 90.1  | 96.5  | 114.0 | 96.1  | 98.9  | 109.9 | 99.0  | 87.3  | 94.7  | 136.5 |

<sup>a</sup>Lard is included.

- Larger for poultry than for meat and larger for meat than for fish

## INCREASE IN THE PRICE INDEX

- Larger for animal products than for plant products
- Larger for vegetables than for fruits
- Larger for fish than for meat and larger for meat than for poultry

The correlation between price changes and trends in food consumption seems strong enough to enable one to deduce that quantities consumed vary inversely with price changes (Table 4). However, this relationship also depends on the nutritional value of the product and the eating habits of Canadians.

## FOOD EXPENDITURES AND DISPOSABLE INCOME

In 1974, total food expenditures were 180 percent higher than the 1961 level of \$5,810 million. About 84 percent of food expenditures were for food used at home, and the remainder represented purchases of meals away from home. Since 1961 there has been a much larger increase in the price index for meals consumed outside the home (128.9 percent) than for the meals

consumed at home (82.8 percent) (Figure 8). The increase in expenditures resulting from the increase in price may simply reflect an adjustment in the budget of consumers in a period of inflation. However, disposable income increased 227.5 percent during the same period; in fact, food expenditures accounted for 21.6 percent of disposable income in 1961 and only 18.8 percent in 1974. In other words, as disposable income increases, the share of income devoted to food decreases. This phenomenon demonstrates that the demand for food with respect to income is inelastic, i.e., not responsive to changes in income.

## EXPENDITURES FOR NON-FOODS

The increase in expenditures for non-foods<sup>3</sup> was less than that for food (93.1 percent compared with 184.7 percent) (Figure 12). The reverse is true if one considers the two in relation to total expenditures. The food share decreased from 22.4 to 20.8 percent while the non-food share increased from 77.6 to 79.2 percent.

<sup>3</sup>Non-foods include the following: shelter, clothing, household operations, transportation, recreation, health care, tobacco, alcohol and personal goods and services.

TABLE 3. PRICE INDEXES: PLANT PRODUCTS – 1961-1973 (1961 = 100)

| Items                    | 1961  | 1962  | 1963  | 1964  | 1965  | 1966  | 1967  | 1968  | 1969  | 1970  | 1971  | 1972  | 1973  |
|--------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| <b>Fruits</b>            |       |       |       |       |       |       |       |       |       |       |       |       |       |
| Oranges                  | 100.0 | 108.3 | 114.5 | 102.6 | 101.9 | 97.7  | 96.2  | 120.8 | 100.5 | 102.5 | 111.9 | 104.4 | 119.8 |
| Bananas                  | 100.0 | 101.7 | 103.4 | 103.1 | 101.5 | 96.9  | 96.3  | 94.1  | 90.7  | 85.7  | 76.2  | 79.3  | 82.8  |
| Apples                   | 100.0 | 91.1  | 98.9  | 99.3  | 103.6 | 104.8 | 111.8 | 124.2 | 128.0 | 112.8 | 118.8 | 123.8 | 160.0 |
| Grapefruit               | 100.0 | 101.6 | 135.3 | 135.4 | 123.2 | 129.8 | 116.9 | 149.7 | 122.3 | 140.9 | 154.8 | 153.4 | 158.7 |
| Canned Peaches           | 100.0 | 97.9  | 105.2 | 110.0 | 115.2 | 126.2 | 128.7 | 139.0 | 140.4 | 139.0 | 135.5 | 140.8 | 155.9 |
| Canned Pears             | 100.0 | 97.9  | 98.6  | 103.2 | 106.1 | 115.2 | 109.4 | 114.5 | 121.4 | 123.7 | 120.7 | 124.5 | 132.7 |
| Canned Apple Juice       | 100.0 | 97.2  | 99.1  | 102.3 | 108.8 | 107.7 | 106.4 | 108.7 | 123.0 | 117.2 | 110.4 | 122.0 | 138.3 |
| Canned Orange Juice      | 100.0 | 93.3  | 114.5 | 139.1 | 115.4 | 99.0  | 92.0  | 102.5 | 109.5 | 108.6 | 108.9 | 115.0 | 112.6 |
| Raisins                  | 100.0 | 107.1 | 117.7 | 118.9 | 121.4 | 124.6 | 127.3 | 139.7 | 149.2 | 153.0 | 150.2 | 153.4 | 207.2 |
| <b>Vegetables</b>        |       |       |       |       |       |       |       |       |       |       |       |       |       |
| Potatoes                 | 100.0 | 99.0  | 107.7 | 124.7 | 160.5 | 133.9 | 117.3 | 131.3 | 123.0 | 134.0 | 114.7 | 128.2 | 212.3 |
| Tomatoes <sup>a</sup>    | 100.0 | 103.8 | 114.6 | 118.9 | 123.4 | 128.2 | 125.3 | 150.3 | 140.5 | 143.7 | 162.2 | 167.5 | 173.7 |
| Lettuce                  | 100.0 | 123.1 | 132.9 | 134.1 | 133.8 | 145.0 | 145.9 | 133.5 | 158.1 | 139.9 | 160.8 | 162.9 | 189.6 |
| Carrots                  | 100.0 | 103.1 | 96.6  | 95.5  | 102.1 | 111.2 | 105.2 | 121.1 | 108.8 | 109.1 | 123.4 | 124.9 | 126.6 |
| Celery                   | 100.0 | 126.3 | 112.6 | 122.9 | 116.5 | 131.4 | 128.3 | 128.7 | 146.7 | 150.3 | 141.6 | 164.2 | 167.4 |
| Onions                   | 100.0 | 123.2 | 114.9 | 106.3 | 125.5 | 132.9 | 147.5 | 151.7 | 136.4 | 157.4 | 128.5 | 157.9 | 221.6 |
| Cabbage                  | 100.0 | 126.1 | 124.4 | 121.6 | 130.6 | 153.0 | 143.3 | 137.6 | 145.2 | 167.4 | 150.4 | 171.9 | 199.1 |
| Turnips                  | 100.0 | 101.8 | 122.0 | 117.8 | 128.6 | 144.7 | 143.3 | 141.8 | 141.8 | 171.0 | 125.1 | 154.2 | 182.0 |
| Canned Peas              | 100.0 | 102.4 | 102.8 | 104.4 | 107.1 | 109.8 | 115.0 | 127.0 | 126.5 | 125.7 | 117.0 | 125.1 | 139.2 |
| Canned Corn              | 100.0 | 97.1  | 97.3  | 105.5 | 104.0 | 108.2 | 112.6 | 120.3 | 123.3 | 124.7 | 119.9 | 122.5 | 131.0 |
| Canned Baked Beans       | 100.0 | 101.9 | 103.8 | 106.2 | 107.7 | 118.6 | 120.8 | 122.6 | 126.8 | 129.3 | 131.6 | 134.5 | 146.4 |
| Canned Tomato Juice      | 100.0 | 96.4  | 98.4  | 110.2 | 117.7 | 119.8 | 122.2 | 124.3 | 123.7 | 125.4 | 125.6 | 134.7 | 147.1 |
| Canned Tomatoes          | 100.0 | 98.6  | 100.4 | 116.6 | 127.8 | 132.8 | 131.7 | 125.8 | 126.7 | 131.6 | 128.9 | 131.9 | 139.7 |
| Sugar                    | 100.0 | 99.7  | 163.9 | 147.5 | 102.9 | 99.6  | 97.6  | 98.6  | 113.0 | 117.2 | 126.2 | 159.8 | 165.9 |
| Beverages                | 100.0 | 101.9 | 104.2 | 116.7 | 116.9 | 117.1 | 117.5 | 119.3 | 120.6 | 127.4 | 129.8 | 134.9 | 138.4 |
| Oils & Fats <sup>b</sup> | 100.0 | 98.3  | 96.4  | 99.0  | 108.2 | 113.2 | 110.9 | 107.0 | 105.6 | 110.6 | 112.6 | 113.8 | 119.9 |
| Cereals                  | 100.0 | 102.2 | 107.1 | 112.1 | 112.7 | 115.7 | 117.4 | 120.0 | 121.5 | 124.1 | 121.9 | 131.3 | 143.3 |

<sup>a</sup>Tomatoes can be calculated with fruits as well as with vegetables.<sup>b</sup>Includes lard.

In the study period, the consumer price index for food increased 88.4 percent while the index for all other goods and services rose only 59.1 percent (Figure 9), which explains why the increase in expenditures for food is larger than the increase for non-food commodities.

As seen in Table 5, the changes in terms of dollars is expressed.

Before concluding this paper, it would be of some interest to consider the impact of the population growth on the total volume of food consumed (Figure 10). From 1961 to 1973, the population of Canada increased 21.1 percent while the total volume of food consumed rose by almost 6.4 billion pounds (24 percent). Per capita consumption of food stayed almost constant (1,446.7 versus 1,481.1 pounds).

It should be borne in mind that not only population growth but also certain socio-economic characteristics account for this increase in the total volume of food consumed. These include age and income distribution, level of education and degree of urbanization.

## SUMMARY AND CONCLUSIONS

Since 1961, there has been a marked change in the food consumption patterns of Canadians. Fruits, oils and fats, sugar and tomatoes have largely accounted for the increase in the volume of plant products consumed, while poultry, red meat and fish, in that order, accounted for similar increases with regard to animal products.

Prices for animal products increased at a greater rate than those for plant products. The same was true for

TABLE 4. FOOD CONSUMED PER CAPITA (POUNDS) AND FOOD PRICE INDEXES, 1961-1973

| Item                  | 1961       | 1962     | 1963     | 1964     | 1965     | 1966     | 1967     | 1968     | 1969     | 1970     | 1971     | 1972     | 1973     |
|-----------------------|------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Fruits and Vegetables | a 100.0    | 103.9    | 109.6    | 113.0    | 116.8    | 117.0    | 116.2    | 128.2    | 125.3    | 126.8    | 130.5    | 139.8    | 166.7    |
|                       | b 100.0    | 99.0     | 97.2     | 97.6     | 100.6    | 105.4    | 106.2    | 105.3    | 101.7    | 102.4    | 102.5    | 102.38   | 107.63   |
|                       | c 506.7    | 504.8    | 495.4    | 497.3    | 512.9    | 537.1    | 541.1    | 536.8    | 518.2    | 522.1    | 522.4    | 521.85   | 548.61   |
| Sugar                 | a 100.0    | 99.7     | 163.9    | 147.5    | 102.9    | 99.6     | 97.6     | 98.6     | 113.0    | 117.2    | 126.2    | 159.8    | 165.9    |
|                       | b 100.0    | 102.92   | 98.11    | 100.60   | 102.30   | 107.07   | 103.23   | 104.95   | 105.67   | 104.60   | 106.57   | 104.97   | 111.04   |
|                       | c 94.92    | 97.69    | 93.13    | 95.49    | 97.10    | 101.63   | 97.98    | 99.62    | 100.30   | 99.29    | 101.16   | 99.64    | 105.40   |
| Beverages             | a 100.0    | 101.9    | 104.2    | 116.7    | 116.9    | 117.1    | 117.5    | 119.3    | 120.6    | 127.4    | 129.8    | 134.9    | 138.4    |
|                       | b 100.0    | 99.30    | 104.54   | 97.90    | 100.00   | 91.33    | 103.42   | 105.66   | 98.81    | 101.82   | 103.98   | 106.99   | 106.99   |
|                       | c 14.31    | 14.21    | 14.96    | 14.01    | 14.28    | 13.07    | 14.80    | 15.12    | 14.14    | 14.57    | 14.88    | 15.31    | 15.31    |
| Eggs                  | a 100.0    | 94.6     | 103.7    | 90.1     | 96.5     | 114.0    | 96.1     | 98.9     | 109.9    | 99.0     | 87.3     | 94.7     | 136.5    |
|                       | b 100.0    | 99.29    | 94.81    | 94.49    | 93.60    | 90.53    | 92.21    | 92.54    | 94.60    | 95.78    | 94.43    | 90.89    | 85.99    |
|                       | c 33.91    | 33.67    | 32.15    | 32.04    | 31.74    | 30.70    | 31.27    | 31.38    | 32.08    | 32.48    | 32.02    | 30.82    | 29.16    |
| Red Meat              | a 100.0    | 106.3    | 105.2    | 102.6    | 108.8    | 122.3    | 121.5    | 122.4    | 133.2    | 135.8    | 131.2    | 147.5    | 181.3    |
|                       | b 100.0    | 100.50   | 102.86   | 107.36   | 107.51   | 106.93   | 112.58   | 113.44   | 111.15   | 114.65   | 121.44   | 118.51   | 114.22   |
|                       | c 139.9    | 140.6    | 143.9    | 150.2    | 150.4    | 149.6    | 157.5    | 158.7    | 155.5    | 160.4    | 169.9    | 165.8    | 159.8    |
| Fish                  | a 100.0    | 102.6    | 105.0    | 106.0    | 111.1    | 122.0    | 124.4    | 127.0    | 136.0    | 150.6    | 157.0    | 180.5    | 222.3    |
|                       | b 100.0    | 95.52    | 116.60   | 104.96   | 106.10   | 105.04   | 93.17    | 99.35    | 102.52   | 97.40    | 92.76    | 109.44   | 106.51   |
|                       | c 12.29    | 11.74    | 14.33    | 12.90    | 13.04    | 12.91    | 11.45    | 12.21    | 12.60    | 11.97    | 11.40    | 13.45    | 13.09    |
| Poultry               | a 100.0    | 102.3    | 104.9    | 100.0    | 102.9    | 111.0    | 106.6    | 109.6    | 109.2    | 105.8    | 108.9    | 124.6    | 164.3    |
|                       | b 100.0    | 99.74    | 106.09   | 113.28   | 117.85   | 126.75   | 131.23   | 183.20   | 138.90   | 145.44   | 143.47   | 146.50   | 150.92   |
|                       | c 31.03    | 30.95    | 23.92    | 35.15    | 36.57    | 39.33    | 40.72    | 39.78    | 43.10    | 45.13    | 44.52    | 45.46    | 46.83    |
| Fats and Oils         | a 100.0    | 98.3     | 96.4     | 99.0     | 108.2    | 113.2    | 110.9    | 107.0    | 105.6    | 110.6    | 112.6    | 113.8    | 119.9    |
|                       | b 100.0    | 100.87   | 99.48    | 99.68    | 96.96    | 113.45   | 117.39   | 120.36   | 124.34   | 123.34   | 124.18   | 131.32   | 132.42   |
|                       | c 30.94    | 31.21    | 30.78    | 30.84    | 30.00    | 35.10    | 36.32    | 37.24    | 38.47    | 38.16    | 38.42    | 40.63    | 40.97    |
| Dairy Products        | a 100.0    | 97.3     | 97.0     | 99.8     | 102.5    | 109.7    | 117.0    | 121.5    | 125.9    | 127.0    | 131.9    | 139.1    | 149.5    |
|                       | b 100.0    | 98.80    | 98.81    | 98.43    | 97.29    | 96.12    | 93.55    | 91.43    | 89.99    | 85.84    | 85.11    | 85.53    | 85.49    |
|                       | c 400.66   | 395.84   | 395.90   | 394.35   | 389.79   | 385.13   | 374.81   | 366.31   | 360.54   | 343.91   | 341.00   | 342.67   | 342.54   |
| Total Food*           | a 100.0    | 101.8    | 105.1    | 106.8    | 109.6    | 116.6    | 118.1    | 122.0    | 127.1    | 130.0    | 131.4    | 141.4    | 162.0    |
|                       | b 100.0    | 99.50    | 99.52    | 99.46    | 101.51   | 102.57   | 102.49   | 101.87   | 100.47   | 100.17   | 100.29   | 100.94   | 102.38   |
|                       | c 1,446.61 | 1,439.42 | 1,439.61 | 1,438.87 | 1,468.42 | 1,483.75 | 1,482.56 | 1,473.63 | 1,453.47 | 1,449.12 | 1,450.83 | 1,460.26 | 1,481.06 |

\* Total food also includes some other products.

a. price index (1961=100).

b. quantity index (1961=100).

c. pounds

vegetables versus fruits, fish versus meat, and meat versus poultry. This trend closely parallels changes in consumption and allows one to conclude that changes in quantities consumed are inversely related to price changes.

Food expenditures increased at a greater rate than food prices and disposable personal income at a greater rate than food expenditures. The share of disposable personal income devoted to food decreased.

Finally, although food expenditures increased at a greater rate than non-food expenditures, the share of

total expenditures represented by food was smaller in 1974 than in 1961.

TABLE 5. SHARE OF FOOD AND NON-FOODS IN TOTAL EXPENDITURES AS EXPRESSED IN DOLLARS AND PERCENTAGE (PER CAPITA)

| Share of total expenditures | 1961     |       | 1974     |       |
|-----------------------------|----------|-------|----------|-------|
|                             | \$       | %     | \$       | %     |
| Food                        | 318.57   | 22.4  | 736.79   | 20.8  |
| Non-Foods                   | 1,103.43 | 77.6  | 2,811.21 | 79.2  |
| Total                       | 1,422.00 | 100.0 | 3,548.00 | 100.0 |

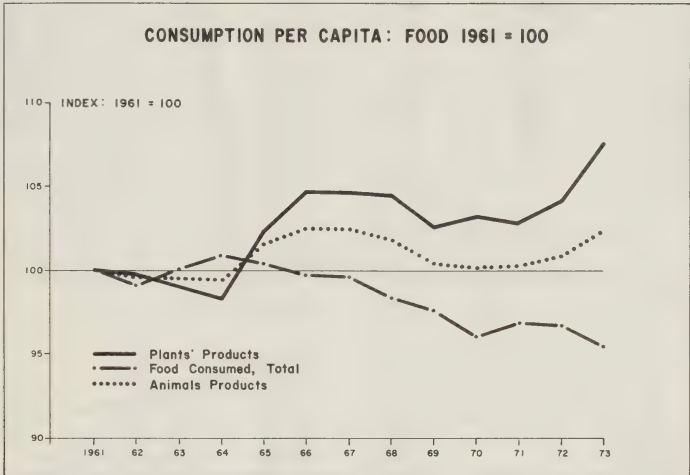


Figure 1

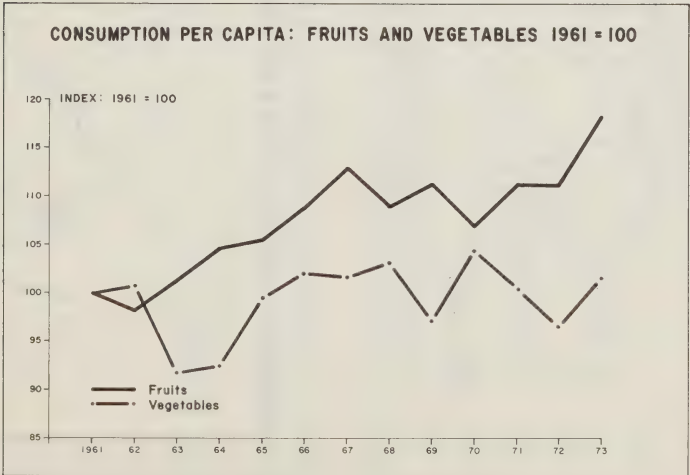


Figure 2

CONSUMPTION PER CAPITA: SUGAR, SYRUPS AND BEVERAGES 1961 = 100

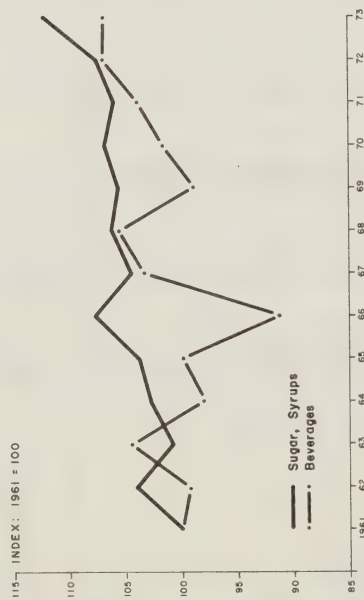


Figure 3

CONSUMPTION PER CAPITA: OILS, FATS, PULSES, NUTS, CEREALS 1961 = 100

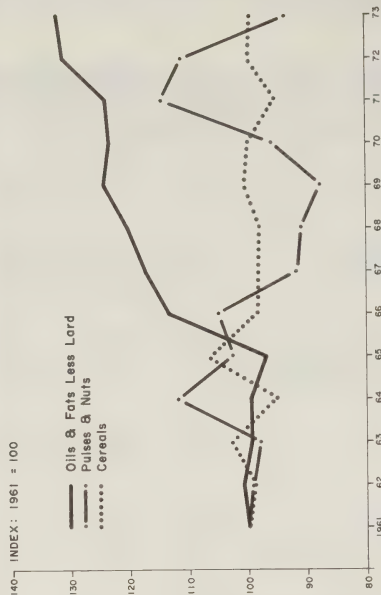


Figure 4

CONSUMPTION PER CAPITA: POTATOES AND TOMATOES 1961 = 100

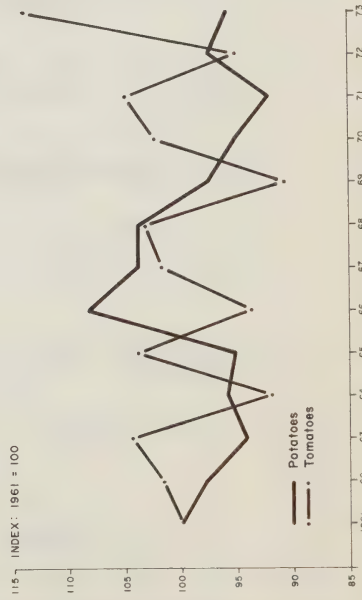


Figure 5

CONSUMPTION PER CAPITA: RED MEAT, POULTRY AND FISH 1961 = 100

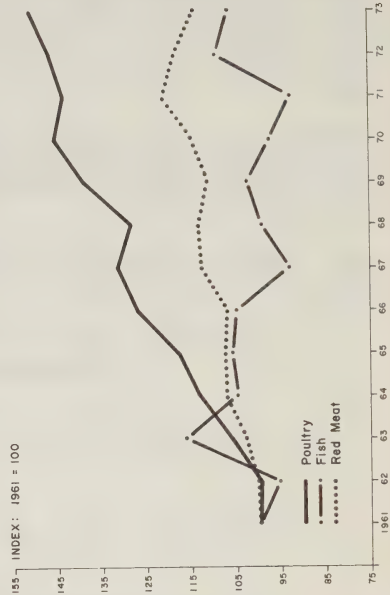


Figure 6

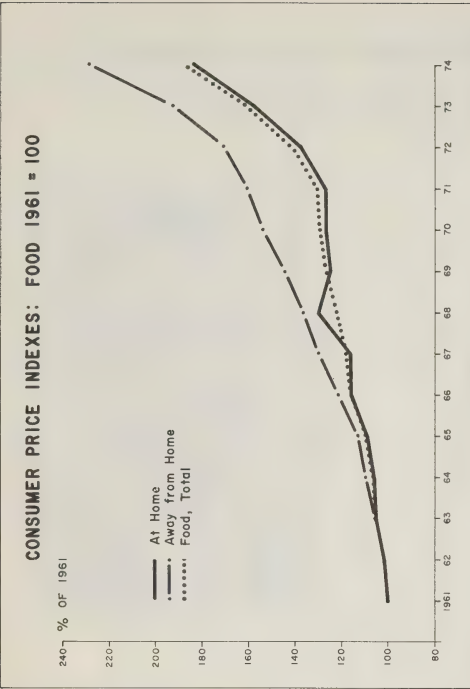


Figure 8

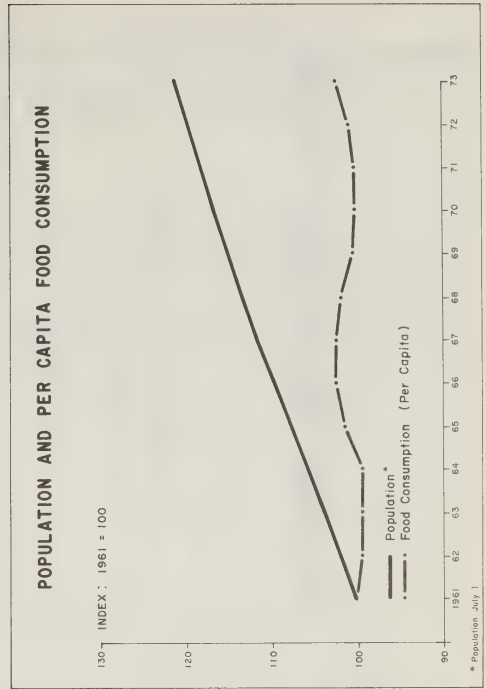


Figure 9

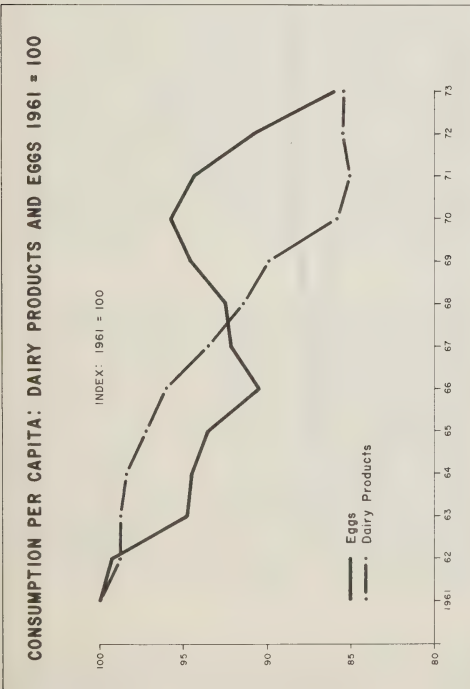


Figure 7

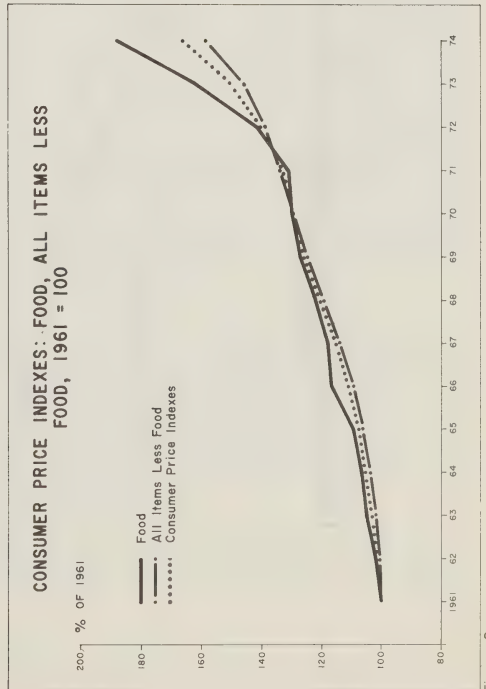


Figure 10

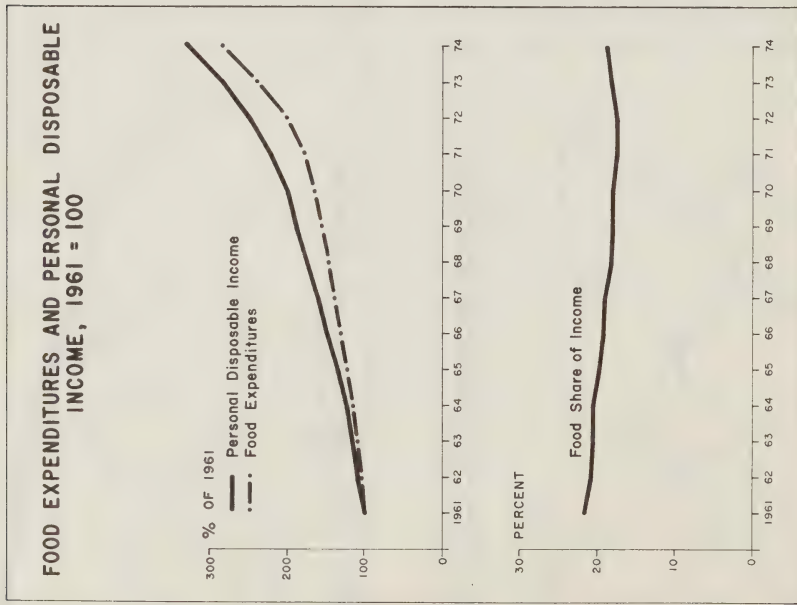


Figure 11

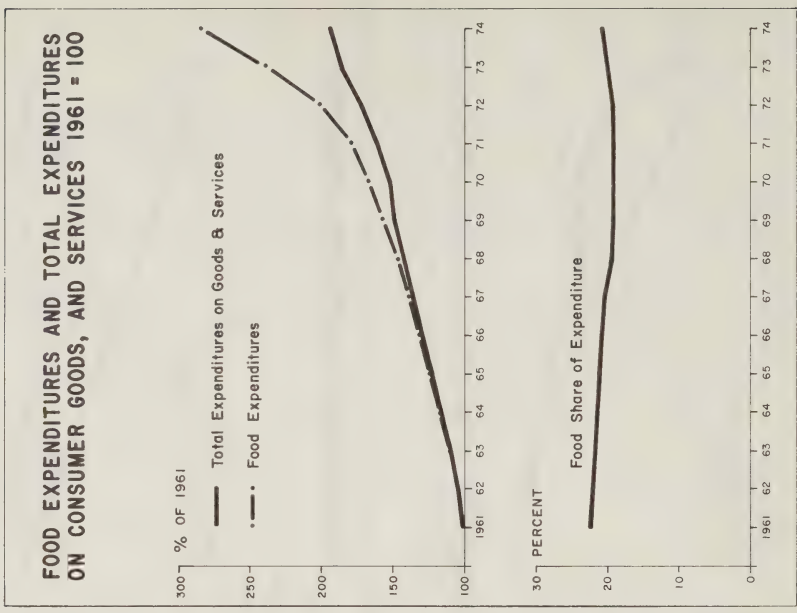
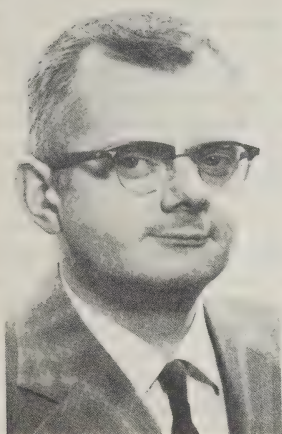


Figure 12

# A PROGRAM FOR CALCULATING THE AMOUNTS AND COSTS OF FEED FOR FEEDER CATTLE



James Lovering\*

*Using a computer program, the amounts and costs of feed can be determined for growing and fattening cattle over their length of keep. The program described permits the calculation of the total requirements of metabolizable energy and crude protein. The animal's age and weight at the beginning of the feeding period and the rate of gain during it are used in the calculation.*

## INTRODUCTION

Economic research and extension activities that deal with growing and fattening cattle frequently require estimates of feed consumption and cost during a feeding period. These estimates are often wanted for several combinations of the level of nutrition, age and weight of animal, and type of feed. These combinations define, to a large extent, alternative enterprises that may be compared and from which one may be selected as most suitable by such means as budgeting or mathematical programming.

It is important that estimates of amounts and costs of input and output items for various alternative enterprises be comparable. For example, it is unlikely that energy requirements taken from experiments done at different times and places, on different classes of cattle using different feeds would be comparable. It is therefore often desirable to use feeding standards to estimate differences in energy and feed requirements between beef production alternatives. It is widely recognized that animal performance in a specific situation may differ considerably from that specified in a feeding standard.

The basis of the computer program discussed in this article is an equation that presents the Agricultural Research Council (U.K.) feeding standard as a continuous function. The output of the program is subject to the same limitations that may be inherent in the A.R.C. feeding standard. For example, neither the feeding standard nor the program are sufficiently detailed to represent differences in breeds, feed palatability or many other significant factors in the conversion of feed to meat. The use of the program should be limited to comparisons between alternative enterprises which assume a common breed and the same environmental conditions.

Since feeding standards typically give only daily feed requirements for relatively narrow animal weight classes, the calculation of feed requirements for the feeding periods commonly found on farms is time consuming. Enterprise alternatives are often limited to those partially defined by the weight and rate-of-gain classes given in the feeding standards.

The computer program<sup>1</sup> described here calculates the length-of-keep requirements of growing and fattening

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<sup>1</sup>Written in Fortran IV and available from the author on request.

cattle for metabolizable energy<sup>2</sup> and crude protein, given the animal's age and weight at the beginning of the feeding period and the rate of gain during it.

## PROGRAM DESCRIPTION

The program is based on an equation formulated by Zulberti and Reid (4), which permits the "...calculation of the total metabolizable energy requirements...for any combination of body weight, rate of weight gain, age, level of muscular work, and metabolizable energy concentration of the diet" on a daily basis. The program uses their equation to compute the total metabolizable energy required (MER) for the first day on feed, then increases the initial weight of the animal by the daily rate of weight gain and increases the animal's age by one day and computes MER for the second day on feed. This procedure is repeated for each day in the feeding period. MER and animal weight are given as sub-totals for each 30-day period and as totals for the entire feeding period (Table 1).

Energy requirements must be translated into feed requirements. That is, a feed or combination of feeds must be specified that will be eaten by the animal in sufficient quantity to provide MER and sustain the desired rate of weight gain. The diet must have an adequately high energy concentration to provide MER, given that the animal has a limited capacity for feed consumption that varies with the ration and with animal weight, age and gain. Guides to minimum energy concentration and maximum intake are provided in feeding standards (2, 3).

This program requires the specification of the qualities of up to four feeds and the proportion that each feed is to comprise of the diet. The proportion that each feed forms of the diet must be such that the diet has an energy concentration equal to or greater than that required to produce the desired rate of gain. Once the program has calculated MER, the mean energy concentration of the ration is used to calculate the total weight of feed. The proportion that each feed makes up of the diet is used to calculate the weight of each feed used.

Provision for calculating the amounts of required protein supplementation is also included in the program. Feeding standards provide minimum crude protein concentrations (RCP) for various weight and rate of gain

classes. The weighted mean crude protein concentration of the diet is computed (from feed proportions and qualities) and compared with RCP to determine the requirement, if any, for supplemental protein. The program uses urea as a protein supplement in diets having relatively high energy concentrations (greater than 2.4 Mcal of metabolizable energy/kg) with the restriction that urea cannot contribute more than 30 percent of all the crude protein in the diet. Diets of low energy concentration or those requiring more protein than can be provided from urea are supplemented with soybean oilmeal (SBOM, 50 percent). The program indicates the amounts of each protein supplement required.

Animal requirements for various feeds can be translated into crop acreages by specifying per-acre yields for each feed. Similarly, if the total available acreage is specified, the program will calculate the number of animals that can be supported, given the specified crop yields. Feed costs for the length of keep are calculated from feed amounts and per-unit feed prices.

## PROGRAM INPUT AND OUTPUT

The computer printout contains both input and output data. These are listed as follows and shown, as an example, in Table 1.

### Input

The following information is needed to use the program (Table 1):

- estimate of the animal's metabolizable energy consumption for muscular work<sup>3</sup>
- animal weight at the beginning of the feeding period
- animal age at the beginning of the feeding period
- daily weight gain
- crude protein requirement, as a proportion of total dry weight of the ration
- length of keep

<sup>2</sup>Metabolizable energy is the difference between total energy in the ration and the energy lost in feces, urine and combustible gases.

<sup>3</sup>Estimates for muscular work are difficult to obtain. The Agricultural Research Council (U.K.) cites 2 kcal/kg of body weight/day (4).

TABLE 1. ESTIMATES OF FEED AMOUNTS, FEED COSTS AND ACREAGE REQUIREMENTS FOR GROWING AND FATTENING CATTLE

| INPUT                       |            |              |                  |                            |              |                       |
|-----------------------------|------------|--------------|------------------|----------------------------|--------------|-----------------------|
| Muscular work (kcal/kg/day) | Age (days) | Weight (lbs) | Daily gain (lbs) | Required protein (prop'tn) | Days on feed | Total acres available |
| 2,000                       | 365        | 550          | 2.87             | 0.111                      | 160          | 100                   |

| Feed Name                     | P     | Q      | R      | S     | Urea  | SBOM  |
|-------------------------------|-------|--------|--------|-------|-------|-------|
| Energy Conc. (Mcal/kg)        | 1.900 | 0.0000 | 0.0000 | 3.100 | —     | —     |
| Proportion in Mix             | 0.392 | 0.0000 | 0.0000 | 0.608 | —     | —     |
| Crude Protein (prop'tn)       | 0.075 | 0.0000 | 0.0000 | 0.120 | —     | —     |
| Price (\$/lb DM) <sup>a</sup> | 0.025 | 0.0000 | 0.0000 | 0.050 | 0.110 | 0.120 |
| Crop Yields (lbs/acre)        | 4000. | 0000.  | 0000.  | 2500. | —     | —     |

| OUTPUT       |            |                     |  |  |      |        |
|--------------|------------|---------------------|--|--|------|--------|
| — per head — |            |                     |  |  |      |        |
| Days on feed | Gain (lbs) | Ending weight (lbs) | Total metabolizable energy required (Mcal) |  |      |        |
| 30           | 86.1       | 636.1               | 602.5                                      |  | IMED | 2.6296 |
| 60           | 172.2      | 722.2               | 1252.0                                     |  | FMED | 2.6201 |
| 90           | 258.3      | 808.3               | 1947.3                                     |  | IMCP | 0.1024 |
| 120          | 344.4      | 894.4               | 2687.5                                     |  | FMCP | 0.1110 |
| 150          | 430.5      | 980.5               | 3472.0                                     |  | FP   | 0.9964 |
| 160          | 459.2      | 1009.2              | 3743.3                                     |  | SP   | 0.0000 |
|              |            |                     |  |  | UP   | 0.0036 |

| Feed Name            | P       | Q      | R      | S       | Urea  | SBOM | Totals  |
|----------------------|---------|--------|--------|---------|-------|------|---------|
| Amount (lbs DM/head) | 1230.20 | 0.0000 | 0.0000 | 1908.07 | 11.35 | 0.00 | 3149.62 |
| Cost (\$/head)       | 30.76   | 0.0000 | 0.0000 | 95.40   | 1.25  | 0.00 | 127.41  |
| Acres/head           | 0.31    | 0.0000 | 0.0000 | 0.76    | —     | —    | 1.07    |
| Acres for herd       | 28.72   | 0.0000 | 0.0000 | 71.28   | —     | —    | 100.00  |

NUMBER OF HEAD WHICH CAN BE SUPPORTED ON TOTAL AVAILABLE ACREAGE: 93

<sup>a</sup>DM = dry matter.

- metabolizable energy concentration for each feed (maximum of four feeds) to be used in formulating the ration
  - proportion that each feed is to form of the ration on a dry weight basis, not considering protein supplements
  - crude protein content of each feed as a proportion of dry weight
  - prices of each feed, soybean oilmeal and urea
- dry weight yield per acre of each feed
  - crop acreage available to grow the feeds.
- Output**

The following items are calculated by the program (Table 1):

  - total metabolizable energy required for each cumulative 30-day period and total length of keep

- animal weight at the end of the feeding period and at each cumulative 30-day period
- total dry weight of the ration including protein supplements
- dry weight of each constituent feed including protein supplements
- acreages required to grow each constituent feed and the total ration excluding protein supplements
- number of animals that can be supported on a given acreage
- IMED, the weighted mean energy concentration of feeds P, Q, R and S mixed in the originally specified proportions (PP, PQ, PR and PS)
- FMED, the weighted mean energy concentration of all feeds including urea and soybean oilmeal
- FP, the proportion that the feeds P, Q, R and S, taken together, make up of the final ration
- UP, the proportion that urea makes up of the final ration
- SP, the proportion that soybean oilmeal makes up of the final ration
- IMCP, the weighted mean crude protein concentration of feeds P, Q, R and S mixed in the originally specified proportions
- FMCP, the weighted mean crude protein concentration of all feeds including urea and soybean oilmeal

## EXAMPLE

The input data in Table 1 represent the following situation. Yearling steers weighing 550 pounds are to be fed for 160 days at an average daily gain of 2.9 pounds. One hundred acres of land are available for feed production. From the N.R.C. standard (3), the estimated crude protein concentration required in the ration for this class of feeder is 11.1 percent. This standard also indicates that the required metabolizable energy concentration is 2.6 Mcal/kg. Two feeds are to be grown: a forage P having an expected dry matter yield of 4,000 per acre with 7.5 percent crude protein and 1.9 Mcal/kg of metabolizable energy; and a cereal S having a dry matter yield of 2,500 pounds per acre with 12 percent crude protein and 3.1 Mcal/kg of metabolizable energy.

Their prices or costs are 2.5 and 5.0 cents a pound, respectively. Urea and soybean oilmeal are priced at 11 and 12 cents a pound, respectively. Feeds P and S need to be fed in proportions that will yield an energy concentration of 2.6 Mcal/kg. An application of the "square method"<sup>4</sup> (2) indicates that feeds P and S should make up 39.2 percent and 60.8 percent, respectively, of the dry matter fed to produce a mean energy concentration of 2.63 Mcal/kg. This marginally higher energy concentration allows for a decrease in energy concentration if urea is used as a protein supplement.

The program output indicates that 3,743 Mcal of metabolizable energy are required and that they can be supplied from 1,230 pounds of feed P and 1,908 pounds of feed S. Eleven pounds of urea are required to increase the crude protein concentration to 11.1 percent. Twenty-nine acres of feed P and 71 acres of feed S will support 93 head at a cost of \$127 per head.

## LIMITATIONS

In addition to any assumptions implicit in Zulberti and Reid's equation (4), this program implicitly assumes that the use of single values for required crude protein and energy concentrations for the length of keep does not result in serious errors in calculating required amounts of energy and protein. The shorter the length of keep over which the ration requirements are calculated, the less likely it is that any such errors will be serious.

Similarly, the use of this program should be limited to situations in which daily gain can be expected to be approximately constant during the feeding period. Feeding programs incorporating widely differing levels of nutrition should therefore be separated into more homogenous parts for calculating feed requirements.

While the metabolizable energy system is not widely used in North America and while animal nutritionists may have differing views on the merits of using various measures of energy as the bases for feeding standards, there is no evidence to suggest that rations formulated on the basis of metabolizable energy are unacceptable

<sup>4</sup> Two feeds, X and Y, having energy levels (or other qualities)  $a_x$  and  $b_y$ , respectively, are to be mixed to obtain an energy level  $c$ , where  $c$  lies between  $a$  and  $b$ . The proportion of X to be used is:

$$\frac{|c - b_y|}{|c - b_y| + |c - a_x|}$$

$$\frac{|c - a_x|}{|c - a_x| + |c - b_y|}$$

for the purposes to which feeding standards may legitimately be put.

The program is relatively inflexible regarding supplemental protein sources. Urea will be used when energy concentration is greater than 2.4 Mcal/kg. The use of urea is limited by the provision in the program that it cannot supply more than 30 percent of the total crude protein in the ration. While urea (281 percent protein equivalent) will likely continue to be the cheapest source of protein where it is physiologically possible to use it, there are some situations where its use may not be feasible because of handling or mixing difficulties.

Similarly, there are many sources of protein other than soybean oilmeal that are not considered in the program. By ignoring differences in the energy values of various protein supplements, a price can easily be placed on soybean oilmeal (50 percent) in the program that is equivalent to the cost per unit of protein in another source. Cost differences among rations that arise because of differences in the energy concentrations of protein supplements which have equal per-unit-of-protein costs are likely to be small.

## USES

In general terms, this program can be used when estimates of length-of-keep feed requirements for growing and fattening cattle are needed. Some of the uses include the estimation of cattle numbers that could be supported on a given feed supply, or conversely, the feed required to support a given number of cattle. The program can also be employed in the comparison of several class of cattle and feeding program alternatives, and to help decide the optimum selling weight of cattle given specific feed and cattle prices.

The program has proven useful in determining the optimum cutting dates for timothy (1). Eight

cutting date treatments resulted in different timothy yields (and hence different costs per pound of dry matter) and different energy and protein concentrations in the harvested grass. The program was used to determine feed amounts and costs for each of eight classes of feeder cattle when each of the eight qualities of timothy were used as the forage component in each ration.

In the example shown in Table 1, the energy-gain ratio (Mcal/lb gain) varies from 7.0 to 9.5. For given feed and animal sale prices, the optimum sale weight can be determined by comparing changes in animal value and feed costs between feeding periods of different lengths. The comparison may be made by varying the length of the feeding period in the program, or by calculating the cost per Mcal of metabolizable energy from the output information (as shown in Table 1) and comparing additional energy cost with the additional value of gain by 30-day periods.

## REFERENCES

1. Lovering, James. "Effect of Timothy Maturity at Harvest on Feeder Cattle Ration Costs". Canadian Farm Economics, Vol. 10, No. 2 (1975), pp. 25-32.
2. Morrison, Frank B. Feeds and Feeding, 22nd Ed., Clinton, Iowa, Morrison Publishing Co., 1956.
3. National Research Council. Nutrient Requirements of Beef Cattle, 4th Ed.; Washington, D.C., National Academy of Sciences, 1970.
4. Zulferti, C.A. and Reid, J.T. "An Equation, Suitable for Computer Use, Based on the ARC Feeding System to Determine the Energy Requirements of Growing and Fattening Cattle". Animal Production, Vol. 14 (1972), pp. 17-23.

## POLICY AND PROGRAM DEVELOPMENTS

### CANADIAN WHEAT BOARD ACT — Amendment

An amendment to the Wheat Board Act, effective October 1, 1975, provided that final payments on deliveries in any pool period shall not be made until on or after January 1 of the calendar year beginning after the end of the pool period. This prevents more than one set of final payments being made in a single taxation year.

The Canadian Wheat Board announced new initial payments, effective October 9, 1975, for deliveries to the Board of basic grades of wheat, oats and barley produced in the areas designated by the Board, basis in store Thunder Bay or Vancouver for the 1975-76 crop year. This was in accord with the Board's policy of revising prices during the year, if necessary, in the light of market prices. The new prices after October 9 are:\*

(former prices in brackets)

No. 1 Canada Western Red Spring Wheat, \$3.75 a bushel (\$2.25)

Durum, \$4.25 (\$2.25)

No. 2 Canada Western Oats, \$1.20 (\$1.10)

No. 2 Canada Western Six Row Barley, \$1.95 (\$1.65)

In January Wheat Board Minister Otto Lang announced that "deferred adjustment payments" totalling more than \$45 million were being mailed to prairie grain producers who delivered grain to the Wheat Board early in the crop year, before initial prices were raised on October 9, and who chose to defer receiving initial payment until after January 1, 1976. These cheques, the Minister said, were a retroactive payment to bring the initial returns into line.

### MEAT INSPECTION ACT — Amendment

An amendment to the Meat Inspection Act, dated September 25, 1975, affected substances used in meat packing plants and importation of meat products from countries other than the U.S.

The law now puts the onus on the manager of a meat packing plant to prove that agents or chemicals, e.g., pesticides and germicides, used in his plant are non-toxic. The Department of Agriculture is given strengthened authority to review and approve chemicals, to certify that they are fit to be used, and to regulate the information on their labels. By the change in section 87 of the Act, travellers abroad, outside the United States are allowed to bring back into Canada samples of food products for their personal use, provided the samples are canned and sterile. This is designed to protect Canadian animals against diseases not yet present in Canada.

### CANADA—U.S. MEAT AGREEMENT

On December 31, 1975, Canada and the United States formally removed all remaining quotas on the flow of meat between the two countries. Agriculture Minister Whelan made the announcement as President Ford was signing a proclamation that rescinded American quotas on shipment of Canadian beef and veal into the U.S. As of January 1, said Mr. Whelan, exports and imports of beef and veal would be under open general licence and individual export and import permits would not be required. The Minister noted that the agreement opened the way for similar arrangements with Australia and New Zealand, both significant exporters of beef to Canada.

### BEEF FOOD AID

Mr. Whelan announced on January 9 that part of Canada's commitment of food aid to hungry countries was being shipped in the form of 6.5 million tins of beef.

Under the World Food Program, shipments have already been made to Mexico, Senegal and Egypt. The remainder is expected to go overseas early this year. This is part of a four-point program to help the Canadian beef industry that was announced early in 1975. The tinned product, known as Canadian Beef Loaf, accounted for the purchase of 14,000 to 15,000 cows at a time when the cattle market was depressed.

### CEMA AGREEMENT EXTENDED

The supplemental agreement on improving operations of the Canadian Egg Marketing Agency, which was due to expire December 31, 1975, has been extended to June 30, 1976. Under the agreement CEMA became responsible for central pricing and selling of eggs to assist the Canadian egg industry in its supply-management

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\*In the October issue of Canadian Farm Economics (p. 28), the initial payment for No. 1 C.W. Red Spring Wheat before October 9, 1975, was listed, according to our source of information, as \$4.25. The figure should have been \$3.75. This applied to the crop year August 1, 1975 to July 31, 1976. The correct figure, \$3.75, is a total of \$2.25, paid August 1, 1975, and \$1.50, paid October 6, 1975.

program. During the extended term of the agreement, finishing touches were to be given to the revised comprehensive egg marketing plan. Proposed revisions are being studied by representatives of provincial supervisory marketing boards and egg marketing boards, the Canadian Egg Producers' Council, and CEMA.

## **SUPPORT FOR MANUFACTURING MILK**

Early in 1975, to counteract an increase in production costs, the target support price for manufacturing milk was raised 10 percent from the 1974 closing figure, to \$11.02 a hundredweight. After the announcement was made, production rose by 11 percent above the same period in 1974, while consumption of fluid milk went down during most of 1975.

At the beginning of this dairy year the Canadian Dairy Commission was authorized to pay a subsidy of up to \$2.66 a cwt for manufacturing milk testing 3.5 percent butterfat. In September the Commission reduced the subsidy to 75 percent of in-quota deliveries. It was also prepared to make a year-end adjustment based on annual shipments.

## **STANDARDS FOR MILK RECORDING PROGRAMS**

In December Mr. Whelan announced that the government was working in co-operation with provincial departments of agriculture, dairy breed associations and other dairy farmer organizations to establish some uniformity within the various milk recording programs in operation today. A complete set of standards has been drafted by the Canadian Milk Recording Board (CMRB). This will enable every milk recording system that meets the standards to have its records accepted as official for use in sire-appraisal and breed-improvement programs.

The members of CMRB have agreed in principle on the national set of standards, and also that the Livestock

Division of Agriculture Canada will monitor compliance of all officially approved milk-recording programs with the standards.

## **PRAIRIE RAIL LINES**

On January 31, 1975, Transport Minister Otto Lang announced an extension for another year of the freeze on prairie rail lines. This protects about one third of the prairie rail system, some 6,283 miles, from possible abandonment. It will allow the Hall Commission on Grain Handling and Transportation to complete its work of determining the transportation needs of prairie communities and the effect on producers of changes in the rail system. Under last year's plan 525 miles of track were scheduled to be abandoned. No further protection is contemplated for that mileage.

## **PILOT PLANT IN SASKATCHEWAN**

Mr. Lang, as minister responsible for the Wheat Board, announced on December 17 that construction would start in January 1976 of a new POS (Protein, Oil and Starch) Plant in Saskatoon. Completion is expected in December of this year. The plant will provide facilities for processing grains and oilseeds for domestic and export markets. It is supported by the Federal Government, the Province of Saskatchewan and other provincial governments, private companies and universities.

## **ASSISTANCE TO PRODUCER GROUPS**

On January 2 the Minister of Agriculture announced that agreements for financial assistance had been signed with seven producer groups for construction or renovation of storage facilities for fruits and vegetables. The groups are in British Columbia, Alberta, Manitoba, Ontario and New Brunswick. Under the Fresh Fruit and Vegetable Storage Construction Financial Assistance Program the federal government gives financial assistance to cover a third of the cost of renovations or construction, to a maximum of \$500,000.

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# **PUBLICATIONS**

*Readers: when ordering publications, please write to the source indicated under the appropriate section.*

## **ECONOMICS BRANCH**

*Available from the Publications Manager, Room 303, Sir John Carling Building, Ottawa, K1A 0C5.*

**Provincial Agricultural Legislation in Quebec.** A.R. Jones and A.A. Darisse, 19 pp. Publ. 75/16.

**Income and Financial Data of Farm Taxfilers, 1973.** W. Darcovich, K. Neumeyer, R. Stevenson, Publ. 75/22.

**Agricultural Economic Research Information System — AERIS — Report No. 6.** A. Trempe, Publ. 75/24.

**Consumer Demand for Major Foods in Canada.** Z.A. Hassan, S. Johnson, Publ. 75/25.

**Food Grading in Canada.** Ottawa, revised 1973, reprinted 1975. 15 pp. 23cm. (Publication 1283). Prepared in the Food Advisory Services. A73-1283.

## AGRICULTURE CANADA

*Available from the Information Division, Agriculture Canada, K1A 0C7.*

**The Lighter.** Quarterly. 23cm. Paper cover, partly bilingual. Vol. 45, No. 4, Fall, 1975, 34 pp. A27-10/45-4.

**Agriculture Abroad.** Bi-monthly digest of agricultural policies and programs in various countries. Issued by the International Liaison Service, Agriculture Canada, in cooperation with the Trade Commissioner Service, Department of Industry, Trade and Commerce. Processed. 25cm. Paper cover. Vol. 30, No. 5, October, 1975. 50 pp. A77-3/30-5.

**Diseases, Insects and Mites of Stone Fruits.** G. Gordon Dustan and Thomas R. Davidson. Ottawa, revised 1973, reprinted 1975. 59 pp. Illus. 23cm. Paper cover. (Publication 915). Prepared in the Research Station, Vineland Station, Ontario. A43-915.

**Growing Strawberries in Eastern Canada (planting and harvesting).** L.P.S. Spangel. Ottawa, 1962, reprinted 1975, 11 pp. Illus. 23cm. Paper cover. (Publication 1172). Prepared in the Central Experimental Farm, Ottawa. A-53-1172.

**Guide to Food Grades.** Ottawa, revised 1975. 16 pp. Tables. 16cm. Paper cover. (Publication 1500). A73-1500.

**Orchard Replant Problems.** R.M. Wensley, Ottawa, revised 1973, reprinted 1975. (4 pp.) 23cm. Paper cover. (Publication 1375). Prepared in the Research Station, Harrow, Ontario. A53-1375.

**Lowbush Blueberry Production.** I.V. Hall, L.E. Aalders, L.P. Jackson, G.W. Wood and C.L. Lockhart. Ottawa, 1972, revised 1975. 42 pp. Illus. 23cm. Paper cover. (Publication 1477). Prepared in the Research Station, Kentville, Nova Scotia. A53-1477.

**Apple Growing in Eastern Canada.** A.D. Crowe, Ottawa, 1975. 50 pp. Illus. Tables. 23cm. Paper cover. (Publication 1553). Prepared in the Research Station, Kentville, Nova Scotia. A53-1553.

*Available from Information Canada, 171 Slater St. Ottawa, K1A 0S9.*

**Grain Elevators in Canada for Crop Year, 1975-76.** As at August 1, 1975, including licensed grain dealers. Ottawa, 1975. 142 pp. Tables. 24cm. Processed. Loose leaf with paper cover and ring binder. Compiled by the Canadian Grain Commission, Winnipeg, Manitoba. A92-6/1976 — \$3 per copy (Canada only). \$3.60 per copy (other countries).

## STATISTICS CANADA

*Available from the Publications Distribution Unit, Statistics Canada, Ottawa, K1A 0T7.*

**Farm Wages in Canada.** August, 1975. Bilingual. C.S. 21-002. 35¢ per copy, \$1.05 per year.

**Grain Trade of Canada, 1973-74.** Ottawa, 1975, 94 pp. Tables. 28cm. Paper cover. Bilingual. Prepared in the Agriculture Division, Crops Section. C.S. 22-201/1974. \$1.40 per copy.

**Agriculture.** Cross-classified socio-economic characteristics of farm operators' families, Canada and provinces. Ottawa, 1975. Various paging. Tables. C.S. 96-715. \$2.10 per copy.

## CONSUMER AND CORPORATE AFFAIRS

*Available from Information Canada, 171 Slater St. Ottawa, K1A 0S9.*

**Broiler Chicken Prices 11.** Ottawa, October 1975. English text. 60 pp. Tables, graphs, 28cm. Paper bound. Bilingual. R.G. 27-20/1975.

**Food Company Profits and Food Prices 11.** Ottawa, October, 1975. English text, 37 pp. Tables, charts. 28cm. Paper cover. Bilingual. R.G. 27-21/1975.

**Beef Pricing 111.** Ottawa, November, 1975. English text. 15 pp. Tables, charts. 28cm. Paper cover. Bilingual. R.G. 27-23/1975.

## PARLIAMENTARY PUBLICATIONS

*Available from Information Canada, 171 Slater St., Ottawa, K1A 0S9.*

**Minutes of Proceedings and Evidence Respecting.** Election of a Chairman and Bill S-10, an Act to amend the Feeds Act. No. 60, Thursday, October 30 and Thursday, November 6, 1975. 26 pp. X1 12-301/1-60. 35¢ per copy.

**Standing Committee on Agriculture.** 1st session, 30th parliament, 23-24, Elizabeth II, 1974-75. Chairman, Mr. Robert Daudin. Bilingual. XC 12-301/1-63. 50¢ per copy.

**Minutes of Proceedings and Evidence Respecting.** Bill C-28 an Act to amend the Animal Contagious Diseases Act. No. 68, Thursday, December 4, 1975. 56 pp. Witness: From the Department of Agriculture. Dr. K.F. Wells, Assistant Deputy Minister, Health of Animals

Branch. Including the 11th report to the House. XC 12-301/1/68. 65¢ per copy.

**Minutes of Proceedings and Evidence Respecting.** Bill C-21, an Act to amend the Agricultural Products Cooperative Marketing Act. No. 69, Tuesday, December 9, 1975. 37 pp.

**Minutes of Proceedings and Evidence Respecting.** Supplementary Estimates (A) 1975-76, under Agriculture. Appearing: The Hon. Eugene Whelan, Minister of Agriculture. Tuesday, December 2, 1975. 34 pp. XC 12-301/1-67. 50¢ per copy.

**Agricultural Stabilization Act.** An Act to amend. Assented to 30th July, 1975. 6 pp. YX 3-301/63. 25¢ per copy.

**Prairie Grain Advance Payments Act, No. 2.** An Act to amend. Assented to 30th July, 1975. 3 pp. YX 3-301/64. 25¢ per copy.

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## DEFINITIONS

*The following definitions are provided to help readers better understand the articles in this issue:*

### Article No. 1

**Regression analysis** — a statistical method used to test a hypothesis on relationships among variables. For example, the effect a change in one variable has on the variable in question may be determined.

### Article No. 2

**Household** — a person or group of persons occupying one dwelling. It usually consists of a family group, with or without lodgers, employees, etc. However, it may consist of two or more families sharing a dwelling, of a group of unrelated persons or of one person living alone.

Source: Dictionary of 1971 Census Terms

**Census family** — consists of a husband and wife (with or without children who have never been married, regardless of age) or a parent with one or more children never married, living in the same dwelling. A family may

consist also of a man or woman living with a guardianship child or ward under 21 years for whom no pay was received. The "head of the family" is the husband in a husband-wife family, or the parent in a one-parent family.

Source: Dictionary of 1971 Census Terms

### Article No. 3

**Price index** — a mathematical procedure for calculating the real value of a product through a number of years. The price index is established by using a base year with which subsequent years are compared in percentages.

**Elasticity** — a calculation made in order to predict the effect a price or income change will have on quantities consumed. Demand is elastic when it changes significantly as a result of a price or income change and, inelastic, when it changes only slightly or not at all.

## IN REPLY

Two readers gave a high rating to the August '75 article on Canada's agricultural trade, by J.S. Lohar. Pierre A. Gélinas, a sales manager for Hydro-Quebec in Rimouski, says that the current international market situation should be reviewed so that producers can be better informed about production requirements.

Dr. Jean-Paul Lemay, a professor in the faculty of agriculture and food science at Laval University, Ste. Foy, Quebec, says that the author gave a detailed review of the trade situation and that the tables on import and export markets complemented the text. However, he poses several questions to the author: 1) What new markets should be developed? 2) What do you think of the regionalization of agricultural production? 3) What do you think of self-sufficiency of Quebec?

The author, replying to M. Gélinas, says that an up-to-date review of Canada's agricultural trade prospects was given at the Canadian Agricultural Outlook Conference in December. The review, by T.M. Burns, Senior Assistant Deputy Minister, Department of Industry, Trade and Commerce, is contained in a report being sent to M. Gélinas.

Dr. Lemay's questions were answered by the author as follows: "1) Although Japan, the United States, and the European Economic Community are likely to remain the major export markets for Canadian farm products, other countries can be expected to increase in importance. Brazil, Mexico and Cuba as well as countries in the Far East are already important markets with growth prospects and the recent increase in export earnings of oil-producing countries will also create additional demand for Canadian farm exports. 2) It is important that agricultural production be located where particular

commodities can be produced most economically. In this way, export as well as domestic markets can be served more efficiently. 3) The level of self-sufficiency in Quebec depends on the available agricultural resources in the province in relation to those of the remainder of the country".

The October '75 article by M.L. Meredith entitled "The Prairie Community System" brought two responses. Rev. Peter McKellar, P. Ag., Associate Secretary, United Church of Canada, commends the author for a useful paper for those involved in rural sociology as a discipline. He adds that few economic papers have discussed the "quality of life" from a Canadian perspective, and looks forward to "similar articles of this quality in future editions". Rev. McKellar finds Canadian Farm Economics as a whole very useful. "The articles are clearly written in a way that most of us, who do not have time to get into an issue in depth, can quickly understand and appreciate", he says.

J. Lewis Robinson, professor of geography at the University of British Columbia, says that he has made xerox copies of the article by M.L. Meredith for the information of students in his class on the geography of Canada. He says that the article will also be of interest to students in the urban geography courses there.

R.J. O'Regan, an economist from Victoria B.C., writes that Canadian Farm Economics is an "excellent publication". The respondent rates the August article on irrigation very useful — "a realistic analysis, with proper use of statistics and well set out". The writer adds that all three articles in the October issue were useful. "The methodology was excellent and useful to me — the format was good and easily followed".

## CORRECTIONS

### Volume 10, Number 5, October 1975

Page 9, column 1, Table 7. There was a miscalculation, where the column "Farm Share" was calculated on farm price, instead of on equivalent price. Table 7 should appear as follows:

TABLE 7. BEEF (6 MAJOR CUTS)

| Year               | Gross Farm value | Farm Equivalent value | Aggregate Retail value | Farm Share |
|--------------------|------------------|-----------------------|------------------------|------------|
| —thousand dollars— |                  |                       |                        | %          |
| 1970               | 502,492          | 1,175,831             | 1,475,057              | 79.71      |
| 1971               | 571,231          | 1,336,680             | 1,609,835              | 83.03      |
| 1972               | 650,935          | 1,523,187             | 1,862,397              | 81.79      |
| 1973               | 833,268          | 1,949,847             | 2,246,202              | 86.81      |

Page 11, footnote 2 — should read: When the temperature of the heat carrier (water, air, gases, etc.) is approximately 95 degrees Celsius or less, the heat is arbitrarily classified as low grade. Waste heat generated by power plants would be low grade because the temperature of the carrier in most cases is about 35 degrees Celsius or lower. Such heat has a potential use in stimulating biological processes in agriculture, eg., in crop production. When the temperature is between 95 and 240 degrees Celsius, the heat is classified as medium grade. Above 240 degrees, it is high grade.

Page 28, column 1, line 7. The initial payment for No. 1 C.W. Red Spring Wheat before October 9, 1975, was

listed, according to our source of information, as \$4.25. The figure should have been \$3.75. This applied to the crop year August 1, 1975 — July 31, 1976. The correct figure, \$3.75, is a total of \$2.25, paid August 1, 1975, and \$1.50, paid October 6, 1975.

Page 32, column 2, line 5 should read: Cultivar — term frequently used in horticulture to signify a named variety of a plant species grown under cultivation as distinguished from a variety growing in the wild or natural state.



IN REPLY TO AUTHORS AND EDITORS REGARDING FEBRUARY 1976  
CANADIAN FARM ECONOMICS

I have read the following article(s):

- (1) Atlantic Lowbush Blueberries
- (2) An Introduction to the Agriculture-Population Linkage Program
- (3) Trends in Food Consumption, Prices and Expenditures, 1961-73
- (4) A Program for Calculating the Amounts and Costs of Feed for Feeder Cattle

My comments are on article number

This article was: not useful 12345678910 very useful.

Because (e.g., The most important economic and social factors were studied. The work was well documented and the conclusions were useful to me).

Beefs                      Bouquets                      (Suggestions to authors, publications committee and editors)

My comments may (        ) may not (        ) be used in a future issue of this publication if the editor wishes.

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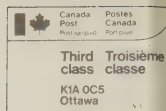
# CONVERSION FACTORS FOR METRIC SYSTEM

| Imperial units         | Approximate<br>conversion factor   | Results in:                          |
|------------------------|------------------------------------|--------------------------------------|
| <b>LINEAR</b>          |                                    |                                      |
| inch                   | x 25                               | millimetre (mm)                      |
| foot                   | x 30                               | centimetre (cm)                      |
| yard                   | x 0.9                              | metre (m)                            |
| mile                   | x 1.6                              | kilometre (km)                       |
| <b>AREA</b>            |                                    |                                      |
| square inch            | x 6.5                              | square centimetre (cm <sup>2</sup> ) |
| square foot            | x 0.09                             | square metre (m <sup>2</sup> )       |
| acre                   | x 0.40                             | hectare (ha)                         |
| <b>VOLUME</b>          |                                    |                                      |
| cubic inch             | x 16                               | cubic centimetre (cm <sup>3</sup> )  |
| cubic foot             | x 28                               | cubic decimetre (dm <sup>3</sup> )   |
| cubic yard             | x 0.8                              | cubic metre (m <sup>3</sup> )        |
| fluid ounce            | x 28                               | millilitre (ml)                      |
| pint                   | x 0.57                             | litre (ℓ)                            |
| quart                  | x 1.1                              | litre (ℓ)                            |
| gallon                 | x 4.5                              | litre (ℓ)                            |
| bushel                 | x 0.36                             | hectolitre (hl)                      |
| <b>WEIGHT</b>          |                                    |                                      |
| ounce                  | x 28                               | gram (g)                             |
| pound                  | x 0.45                             | kilogram (kg)                        |
| short ton (2000 lb)    | x 0.9                              | tonne (t)                            |
| <b>TEMPERATURE</b>     |                                    |                                      |
| degrees Fahrenheit     | (°F-32) x 0.56<br>or (°F-32) x 5/9 | degrees Celsius (°C)                 |
| <b>PRESSURE</b>        |                                    |                                      |
| pounds per square inch | x 6.9                              | kilopascal (kPa)                     |
| <b>POWER</b>           |                                    |                                      |
| horsepower             | x 746                              | watt (W)                             |
|                        | x 0.75                             | kilowatt (kW)                        |
| <b>SPEED</b>           |                                    |                                      |
| feet per second        | x 0.30                             | metres per second (m/s)              |
| miles per hour         | x 1.6                              | kilometres per hour (km/h)           |
| <b>AGRICULTURE</b>     |                                    |                                      |
| gallons per acre       | x 11.23                            | litres per hectare (ℓ/ha)            |
| quarts per acre        | x 2.8                              | litres per hectare (ℓ/ha)            |
| pints per acre         | x 1.4                              | litres per hectare (ℓ/ha)            |
| fluid ounces per acre  | x 70                               | millilitres per hectare (ml/ha)      |
| tons per acre          | x 2.24                             | tonnes per hectare (t/ha)            |
| pounds per acre        | x 1.12                             | kilograms per hectare (kg/ha)        |
| ounces per acre        | x 70                               | grams per hectare (g/ha)             |
| plants per acre        | x 2.47                             | plants per hectare (plants/ha)       |

Examples: 2 miles x 1.6 = 3.2 km; 15 bu/ac x 0.90 = 13.5 hl/ha

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APRIL 1976

# CANADIAN FARM ECONOMICS

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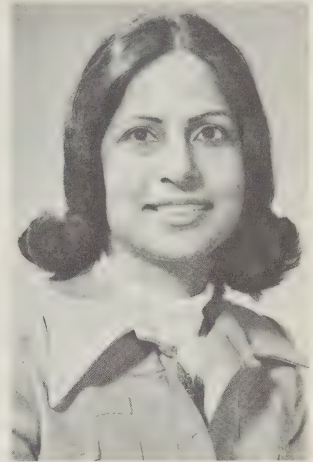
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**Letters from readers:** Letters are encouraged and should be addressed to the author or the Managing Editor. Responses... comments, suggestions and points of view are important for effective two-way communications. Letters may be used in the following issue of CFE and will be edited prior to publication where necessary.

# DEMAND PROJECTIONS FOR AGRICULTURAL COMMODITIES, 1980 AND 1985

*Projections for 1985 indicate that total consumption for most food products will have increased. Growth in per capita consumption is predicted for sugar and syrups, fats and oils (except lard), fruits, vegetables, red meats, poultry and beverages. Decreases are expected for pulses and nuts, lard, eggs and dairy products (except cheese).*



Sushma Barewal\*

## INTRODUCTION

Demand projections for agricultural products provide a useful basis for decisions by all components of the agricultural and food sector. Estimates of the aggregate demand for food normally involve estimates of future population and per capita consumption. Per capita consumption depends on real disposable income, relative prices, availability of foods, and tastes and preferences, all changing over time. In periods of political and economic stability, future population and personal disposable income can be estimated fairly accurately. The effects of sociological factors can also be traced through income elasticities and time-series data. However, because of the dynamic nature of the variables, this study limits its projection period to 10 years.

Per capita consumption projections made here are the estimates expected if present consumption trends continue. These estimates are based on explicit assumptions about relevant variables and follow from the models selected to determine them. They should not be interpreted as forecasts or targets; a forecast reflects the opinion of the forecaster and is not necessarily based on scientific procedure while a target refers to a desired level envisaged by economic planners and is usually optimistic. For example, when demand exceeds supply,

production targets are generally greater than actual supply but in the case of a surplus, they tend to be less than actual supply.

This discussion is presented in two parts. The first briefly describes how the projections were calculated. The second discusses the projected estimates of per capita and aggregate consumption of food and compares them with the trend in consumption as it evolved from the time-series data.

## PROCEDURE

### • Relevant Variables

As discussed in the introduction, the variables considered relevant to estimating aggregate demand for food are real personal disposable income, population, prices and government policies. The effect of changes in tastes and preferences was incorporated in the results by using the growth rates calculated from the per capita consumption data for the 1961-74 period.

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TABLE 1. PERSONAL DISPOSABLE INCOME IN CURRENT AND 1971 DOLLARS, 1970-85

| Year | With No Change in Government Policy as of 1974           |                                      |   |  | With Maximum Effect of the 1975 Wage and Price Controls |   |  |                                     |
|------|--|--------------------------------------|---|--|---|---|--|-------------------------------------|
|      | Personal Disposable Income (millions of current dollars) | Implicit Price Deflator (1971 = 100) | Personal Disposable Income (millions of 1971 dollars) | Per Capita Personal Disposable Income (dollars) <sup>c</sup> | Rate of Growth of Real Total Income                     | Personal Disposable Income (millions of 1971 dollars) | Per Capita Personal Disposable Income (dollars) <sup>c</sup> | Rate of Growth of Real Total Income |
| 1970 | 54,009 <sup>a</sup>                                      | 97.7 <sup>a</sup>                    | 55,280  | 2,596  |   |   |  |                                     |
| 1971 | 59,727   | 100.0                                | 59,727  | 2,769  | 8.045   |   |  |                                     |
| 1972 | 67,496   | 104.3                                | 64,713  | 2,964  | 8.348   |   |  |                                     |
| 1973 | 77,361   | 111.1                                | 69,632  | 3,152  | 7.601   |   |  |                                     |
| 1974 | 89,339   | 122.8                                | 72,752  | 3,241  | 4.481   |   |  |                                     |
| 1975 |  |                                      | 74,221 <sup>b</sup>                                   | 3,288  | 2.020 <sup>d</sup>                                      | 74,221 <sup>b</sup>                                   | 3,288  | 2.02 <sup>d</sup>                   |
| 1976 |  |                                      | 77,726  | 3,402  | 4.722   | 77,190  | 3,379  | 4.00                                |
| 1977 |  |                                      | 83,511  | 3,609  | 7.443   | 81,698  | 3,530  | 5.84                                |
| 1978 |  |                                      | 90,058  | 3,839  | 7.840   | 86,861  | 3,703  | 6.32                                |
| 1979 |  |                                      | 94,913  | 3,991  | 5.390   | 90,257  | 3,795  | 3.91                                |
| 1980 |  |                                      | 98,692  | 4,091  | 3.982   | 90,469  | 3,833  | 2.45                                |
| 1981 |  |                                      | 103,619   | 4,234  | 4.992   | 97,083  | 3,967  | 4.99                                |
| 1982 |  |                                      | 109,215   | 4,399  | 5.401   | 102,325   | 4,121  | 5.40                                |
| 1983 |  |                                      | 114,884   | 4,561  | 5.191   | 102,430   | 4,067  | 5.19                                |
| 1984 |  |                                      | 121,121   | 4,741  | 5.429   | 107,992   | 4,227  | 5.43                                |
| 1985 |  |                                      | 127,800   | 4,933  | 5.514   | 113,943   | 4,398  | 5.51                                |

<sup>a</sup>Data for personal disposable income (current dollars) and for implicit price deflators (1971 = 100), 1970-74, were obtained from Statistics Canada, National Income and Expenditure Accounts, Cat. 13-537.

<sup>b</sup>Data for personal disposable income (1971 dollars) for the years 1975-85, were calculated by applying the growth in columns 6 and 9 to the 1974 figure of personal disposable income (1971 dollars).

<sup>c</sup>Based on Table 2 for the years 1975-85.

<sup>d</sup>Based on data released by Informetrica Limited, Ottawa, 1975.

## • Assumptions

Critical to the interpretation of the results are the following assumptions.

**Income:** Yearly growth rates of personal disposable income for the 1975-85 period were recently published by an economic consulting firm. These rates were based on assumptions of no major change in government policy as of 1974 and the maximum effect of the October 1975 federal wage and price guidelines. The rates were then applied to the 1974 Statistics Canada estimate of personal disposable income, expressed in 1971 dollars. The projected aggregate disposable income was converted to per capita disposable income (Table 1) by using the projected population figures.

**Population:** Much of the increase in demand for food items is due to increases in population. Consequently, projections of consumer demand must take into consideration reliable estimates of population. In June, 1974, Statistics Canada published population estimates for Canada and the provinces to the year 2001. "Projection B"<sup>1</sup> from their estimates gave the most likely results for this study as it was based on indications of the future impact of population policies and the effect of socio-economic development in developed regions (Table 2).

**Prices:** The study's assumption of constant prices implied that (1) real price ratios between individual commodities will not change, (2) the over-all level of real prices received by farmers will remain constant, and (3) consumers will have the same levels of real expenditures among various commodities in the projected period as were made in 1969. A desirable alternative is to have a separate price projection for each commodity. Since reliable price-predicting equations are not yet available for all commodities, their use would have introduced an error in the estimates. However, in the discussion of results, upward or downward trends in the prices of commodities were tied where applicable, to the per capita consumption levels. It is generally agreed that the assumption of constant prices does provide reasonable estimates of projected demand. Both Z.J. Yankowsky et al., [9] and FAO [3] thought it is necessary to incorporate this assumption in projecting domestic demand for agricultural commodities.

**Policies:** Although changes in government policies can influence the domestic and export demand for agricul-

TABLE 2. POPULATION PROJECTION — CANADA (1976-85)

| Year | Population<br>(thousands of persons) <sup>a</sup> |
|------|---|
| 1976 | 22,846.3  |
| 1977 | 23,141.6  |
| 1978 | 23,456.0  |
| 1979 | 23,784.4  |
| 1980 | 24,124.0  |
| 1981 | 24,472.5  |
| 1982 | 24,827.5  |
| 1983 | 25,186.5  |
| 1984 | 25,547.0  |
| 1985 | 25,907.2  |

<sup>a</sup> Assumptions used in 'Projection B'

|  |            |
|--|------------|
| Fertility rate (medium)                        | 2.20       |
| Migration                                      |            |
| i) International (net gain/year)               | 60,000.00  |
| ii) Interprovincial (gross movement of people) | 435,000.00 |
| Indicated growth                               | %          |
| 1971-76  | 1,278,000  |
| 1976-81  | 1,626,200  |
| 1981-86  | 1,786,100  |
|  | 5.93       |
|  | 7.12       |
|  | 7.30       |

Source: Statistics Canada, Population Projections for Canada and the Provinces, Catalogue 91-514.

tural products, it is difficult to foresee what these changes will be. As indicated earlier, the federal wage and price guidelines were taken into account in the calculation of personal disposable income. Otherwise, it was assumed that the policies current in 1974 would remain unchanged to 1985.

## • Data

The second step in making demand projections was the selection of food commodities to be covered and the appropriate base period. In selecting commodities, the food consumption patterns of Canadians were kept in mind.

Data on the per capita consumption of selected food items for the 1961-1974 period were collected<sup>2</sup>. To eliminate short-term fluctuations, a data base period was selected as the average of the per capita consumption for the three years, 1970, 1971 and 1972 (Table 3).

<sup>1</sup> Statistics Canada made four sets of projections to cover the variations in the factors responsible for growth in population.

<sup>2</sup> Statistics Canada, Apparent Per Capita Domestic Disappearance of Food in Canada, Cat. 32-226, Ottawa, Annual.

## • Income Elasticities

Several studies have been conducted to determine the income elasticities of food in Canada. Since the food items selected for this study were not covered under any one previous study, it was necessary to use three

sources: (1) income elasticities for wheat, and pulses and nuts estimated by Z.J. Yankowsky, *et al.* [9], (2) income elasticities for cheddar cheese, process cheese and cottage cheese by W.F. Lu and R.G. Marshall, [5] and (3) income elasticities for all other food items from the Z.A. Hassan and W.F. Lu study [2] (Table 3).

TABLE 3. PER CAPITA FOOD CONSUMPTION – CANADA (1961-74)

| Item   |   | Income Elasticity | 1961-74 Growth Rate | 1961 <sup>a</sup> | 1970-72 <sup>a</sup> | 1974 <sup>a</sup> |
|--|---|-------------------|---------------------|-------------------|----------------------|-------------------|
| Disposable income (per capita)                       |   |                   |                     |                   |                      |                   |
| dollars (1971)                                       |   |                   |                     |                   | 2,776                | 3,241             |
| Population, thousands of persons                     |   |                   |                     | 18,238            | 21,565               | 22,446            |
| Cereals  | retail weight                                 | .0448             | -0.2226             | 152.18            | 150.26               | 153.60            |
| Sugar and Syrups                                     | "   | .1175             | 0.5336              | 98.81             | 114.13               | 95.45             |
| Sugar  | "   | .1175             | 0.7615              | 89.41             | 101.43               | 91.83             |
| Pulses and Nuts                                      |   | -.25              | 0.2662              | 16.53             | 17.0                 | 20.46             |
| Fats and Oils  | "   |                   |                     |                   |                      |                   |
| Margarine  | "   | .1019             | 0.4879              | 10.03             | 9.42                 | 10.72             |
| Lard   | "   | -.4073            | -0.5325             | 8.5               | 7.87                 | 7.5               |
| Shortening & Shortening Oils                         | "   | .2209             | 5.5711              | 9.19              | 15.64                | 17.04             |
| Salad Oils   | "   | .2908             | 6.0312              | 3.22              | 6.15                 | 7.63              |
| Fruits   | fresh equivalent weight                       | .1616             | 1.0481              | 172.70            | 189.56               | 193.73            |
| Vegetables – excluding tomatoes, potatoes, Mushrooms | "   | .0469             | 0.5990              | 114.0             | 114.53               | 124.75            |
| Tomatoes   | "   | .2960             | 0.5671              | 58.6              | 59.11                | 64.79             |
| Potatoes   | "   | .1005             | 0.3698              | 147.95            | 158.44               | 152.38            |
| Meat   | carcass weight                                |                   |                     |                   |                      |                   |
| Beef   | "   | .5057             | 2.1273              | 70.55             | 88.69                | 94.72             |
| Veal   | "   | .5151             | -6.3997             | 6.80              | 4.27                 | 3.48              |
| Mutton and Lamb                                      | "   | .6761             | 0.0229              | 3.50              | 4.20                 | 2.54              |
| Pork   | "   | .1325             | 2.1422              | 50.30             | 62.68                | 59.83             |
| Poultry <sup>b</sup>                                 | eviscerated weight                            | .1514             | 3.4432              | 31.03             | 45.03                | 45.47             |
| Chicken  | "   | .1490             | 4.7278              | —                 | 30.87                | 31.00             |
| Turkey   | "   | .1746             | 2.4140              | 7.60              | 10.27                | 10.53             |
| Fish   | edible weight                                 | .2173             | -0.4241             | 12.29             | 12.28                | 11.81             |
| Eggs   | fresh equivalent weight                       | 0.0               | 0.8707              | 33.91             | 31.77                | 28.50             |
| Dairy Products                                       | retail weight                                 | .1263             | -1.5152             | 396.94            | 337.60               | 336.76            |
| Creamery Butter                                      | "   | .1133             | -2.2344             | 15.78             | 15.01                | 12.93             |
| Cheddar cheese                                       | "   | .5200             | 3.9179              | 2.88              | 4.15                 | 5.25              |
| Process cheese                                       | "   | .6500             | 4.5753              | 3.15              | 4.81                 | 5.70              |
| Other cheese   | "   | .6500             | 9.8665              | 1.42              | 3.60                 | 4.29              |
| Cottage cheese                                       | "   | .2500             | 4.8806              | 1.31              | 2.16                 | 2.27              |
| Powdered skim milk                                   | "   | 0.0               | -3.5826             | 8.39              | 5.34                 | 5.61              |
| Concen. whole milk prds.                             | "   | .2462             | -3.8481             | 19.14             | 13.37                | 11.50             |
| Concen. milk by-prds.                                | "   | .2462             | 0.4587              | 10.98             | 10.38                | 15.56             |
| Fluid Milk   | "   | .0801             | -1.7539             | 332.34            | 273.30               | 273.73            |
| Dairy Products                                       | milk equivalent                               | .1263             | -1.0400             | 865.83            | 821.26               | 792.80            |
| Beverages  | tea leaf equivalent and green bean equivalent | 1545              | 0.3035              | 14.31             | 13.79                | 15.11             |

Source: <sup>a</sup>Statistics Canada, Apparent per Capita Domestic Disappearance of Food in Canada, Cat. 32-226, Annual.

<sup>b</sup>Includes chicken, turkey, fowl, duck and goose.

Income elasticities for the selected items are generally low in Canada as in other developed countries. This means that increases in income will not alter greatly the aggregate demand for these commodities. It is projected that most of the increases in consumption will come from increase in population.

The projection procedure used here assumes that per capita consumption and income values in the base period constitute a point on the consumption function. Using estimates of per capita income, per capita consumption, and estimated income elasticities for the base period, future consumption was estimated for other income levels by applying the Engel curve relationships<sup>3</sup>.

## RESULTS

Essential to projections of domestic demand for food are the projection figures for disposable income and population (Tables 1 and 2). Significant increases in the disposable income and the population of Canada are expected by 1980 and 1985. By 1985 per capita disposable income is expected to increase to \$4,933 (1971 dollars). This is 79 percent above the base period level. Canada's population is expected to grow 7.1 percent between 1976 and 1981 and 7.3 percent between 1981 and 1986. The projected population for 1985 is twenty-six million.

The projections show that the total quantity of food consumed on a per capita basis will not vary significantly from that consumed in the 1970-72 base period.<sup>4</sup> There are indications, however, that the composition of the food basket will change.

### • Meat

Per capita consumption of beef and pork has trended upward over the past decade and this trend is expected to continue. Consumers have demonstrated a strong preference for beef whose per capita consumption continued to increase in spite of increases in the retail price. The per capita consumption of beef and pork are expected to be 114.5 and 67.5 pounds respectively in 1985. Per capita consumption of mutton and lamb increased slowly from 1961 to 1975<sup>5</sup>. In 1974, however, it decreased to 2.5 pounds from 3.7 pounds in 1973 because of the sharply higher prices<sup>6</sup>. It is expected to rise again, reaching about 5.8 pounds per capita by 1985.

The decline in per capita consumption of veal from its peak of 8.3 pounds in 1965 to its low of 3.1 pounds in 1973 has paralleled its supply for that period. A plausible explanation for the rapid decrease in the availability of veal calves for slaughter is that dairy cow numbers declined by 288 thousand head between June 1, 1965 and 1971. Also, in recent years more dairy steers are being fed out as slaughter cattle. The expansion phase of the beef cattle cycle is evident by an increase in cattle and calf slaughter in 1974 and 1975. However, high rates of female slaughter mean an end to the expansion phase. Per capita consumption of veal increased to 3.5 pounds in 1974 and is expected to continue to increase for the next few years. Because 1974 appeared to be the beginning of an upward trend in consumption of veal, it seemed that using a growth rate of -1.5 instead of the calculated value of -6.319 to allow for trend would give more reasonable projection estimates. The projected per capita consumption in 1985 is 4.6 pounds.

### • Poultry

Between 1961 and 1974 per capita consumption of poultry meat increased 46 percent. Much of this increase has been attributed to stepped-up production and declining absolute and relative prices. Since one of the major assumptions behind these projections is constant prices, the increase in consumption of poultry is indicated to continue but at a slower rate than the average of 3.4 percent in recent years.

<sup>5</sup> A detailed analysis of the trends in food consumption was published in an article by D.T. Karamchandani in the February 1976 issue of Canadian Farm Economics.

<sup>6</sup> Much of the mutton and lamb consumed in Canada is imported from Australia and New Zealand and the fluctuations in its price can be linked with the quantity imported into the country.

<sup>3</sup> An Engel curve demonstrates how the consumption level varies with the level of income.

The three functions used were:

(1) double-logarithmic  
 $\ln(y_1) = \ln(y_2) + B\ln(x_1) - B\ln(x_2)$

(2) semi-logarithmic  
 $y_1 = y_2 [B\ln(x_1) - B\ln(x_2)] + 1$

(3) log-inverse  
 $\ln(y_1) = B(1 - \frac{x_2}{x_1}) + \ln(y_2)$

where:  $y_1$  represents projected per capita consumption  
 $y_2$  represents a base period per capita consumption  
 $B$  is a coefficient of income elasticity  
 $x_1$  is the projected disposable income level  
 $x_2$  is the base period disposable income level.

<sup>4</sup> Estimates were made using all three functions described above. The results in Table 4 use the semi-logarithmic function. The double-log gave estimates that were a little higher and the log-inverse gave estimates that were slightly lower than those with the semi-logarithmic function.

## ● Fish

Per capita consumption of fish is expected to rise to about 13.1 pounds in 1985. This, however, is not a significant increase from the 1970-72 level of 12.3 pounds.

## ● Dairy Products

Consumption of dairy products is declining from its level in 1961. Rising prices and health concerns are the probable causes. The general advice of the medical profession to reduce cholesterol intake may have been reflected in the continual decline in per capita consumption of butter and fluid milk during the 1961-74 period. Changes in the per capita consumption of butter also seem linked to changes in the price of butter relative to the price of margarine (cross price elasticity of butter for margarine is .3832)<sup>7</sup>. Given the long-term dairy support policy of the federal government, increases in the price of butter are expected to be much larger than increases in the price of margarine. This change in relative prices would then cause a drop in butter consumption. Using both the income elasticity and the trend factor in the calculations, it is projected that per capita consumption of butter will be 8.9 pounds in 1985. Further reductions in the per capita consumption of powdered skim milk, concentrated whole milk and fluid milk are also expected.

All classes of cheese have increased in popularity with consumers in the past 15 years. The biggest percentage increases in consumption were for process cheese and other cheeses (mostly imported). It is projected that by 1985 there will be a further increase of about 30 percent in the per capita consumption of total cheese compared with the 1970-72 level.

## ● Eggs

The consumption of eggs in Canada does not vary with increases in income. Adjustments were made to incorporate the trend factor and it was projected that the per capita consumption of eggs will decline only slightly from the 1970-72 level of 31.8 pounds.

## ● Fruits

The consumption of fruits (and vegetables) generally shows greater annual variation than other items because

prices depend on crop size. The consumption of fruits (excluding tomatoes) has increased since 1961. The trend appears to be toward greater consumption of fresh fruits and juices. In 1973, the per capita consumption of fruit juices was 40 percent higher than in 1961. Canned, frozen and dried fruits showed small yearly variations but no increasing or decreasing trend is apparent.

## ● Vegetables

The per capita consumption of vegetables (excluding potatoes and mushrooms) has changed very little since 1961 and increases in total domestic demand in 1980 and 1985 will depend mainly on increases in Canada's population. The increase in consumption of tomatoes has almost paralleled the increase in vegetables. By 1985 per capita consumption is expected to be 17 percent higher than in the 1970-72 period.

## ● Fats and Oils

With the exception of lard, the components of the fats and oils group are expected to be consumed in larger quantities in 1980 and 1985. Lard has a negative income elasticity and its projected consumption in 1985 is 24 percent lower than the 1970-72 level.

## ● Cereals

Historical data indicate little change in the per capita consumption of cereals in the past 10 years. Cereals tend to have a very low income elasticity in high income countries and it is projected in 1985 that consumption will be almost unchanged from the 1970-72 level. There might, however, be a shift within the cereals group.

## ● Sugar and Syrups

The consumption of sugar and syrups was stable until 1974. A world-wide shortage of sugar caused the average retail price to rise to 40.3 cents per pound in 1974 compared with 15.5 cents in 1973.

The per capita consumption of sugar consequently declined to 89 pounds in 1974 from 111 pounds in 1973. The retail price declined in 1975 and it is expected that in 1985 consumption will be 121.8 pounds. This represents a 7-percent increase over the 1970-72 level. The consumption of refined sugar is expected to move parallel to that of sugar and syrups.

## ● Nuts and Pulses

The per capita consumption of nuts and pulses is expected to decline with increases in income. Total

<sup>7</sup>Consumer Demand for Dairy Products in Canada, Z. A. Hassan and R.K. Sahi, Canadian Journal of Agricultural Economics, February 1976.

|                                    | With No Change in Government Policy |                              |        | With Maximum Effect of Wage and Price Controls of October 1975 |        |                              |
|------------------------------------|-------------------------------------|------------------------------|--------|--|--------|------------------------------|
|                                    | 1980                                | 1980 as a percent of 1970-72 | 1985   | 1980 as a percent of 1970-72                                   | 1985   | 1985 as a percent of 1970-72 |
| Disposable income (per capita)     | 4,091                               |                              | 4,933  | 3,833  | 4,398  |                              |
| Population                         | 24,124                              |                              | 25,907 | 24,124   | 25,907 |                              |
| Cereals                            | 149.9                               | 99.8                         | 149.5  | 99.5   | 148.7  | 99.0                         |
| Sugar and Syrups                   | 119.3                               | 104.5                        | 121.8  | 106.7  | 120.5  | 105.6                        |
| Sugar                              | 106.1                               | 104.6                        | 108.3  | 106.8  | 107.1  | 105.6                        |
| Pulses and Nuts                    | 15.8                                | 92.9                         | 15.2   | 89.4   | 15.7   | 92.4                         |
| Fats and Oils                      |                                     |                              |        |  |        |                              |
| Margarine                          | 9.8                                 | 104.0                        | 10.0   | 106.2  | 9.9    | 105.1                        |
| Lard                               | 6.6                                 | 83.9                         | 6.0    | 76.2   | 6.5    | 82.6                         |
| Shortening and Shortening Oils     | 19.0                                | 121.0                        | 20.7   | 131.9  | 20.4   | 129.9                        |
| Salad Oils                         | 7.7                                 | 126.2                        | 8.5    | 139.3  | 8.4    | 137.8                        |
| Fruits                             | 201.4                               | 106.2                        | 207.2  | 109.3  | 204.2  | 107.7                        |
| Vegetables - excluding tomatoes    |                                     |                              |        |  |        |                              |
| potatoes, mushrooms                | 116.6                               | 101.8                        | 117.6  | 102.7  | 117.0  | 102.2                        |
| Tomatoes                           | 65.9                                | 111.5                        | 69.2   | 117.1  | 67.7   | 114.5                        |
| Potatoes                           | 164.6                               | 103.9                        | 167.6  | 105.8  | 165.9  | 104.7                        |
| Meat                               |                                     |                              |        |  |        |                              |
| Beef                               | 106.1                               | 119.6                        | 114.5  | 129.1  | 111.9  | 126.2                        |
| Veal                               | 4.5                                 | 119.4                        | 4.6    | 107.7  | 4.5    | 105.4                        |
| Mutton and lamb                    | 5.3                                 | 126.2                        | 5.8    | 138.1  | 5.7    | 135.7                        |
| Pork                               | 65.9                                | 105.1                        | 67.5   | 107.7  | 66.6   | 106.3                        |
| Poultry <sup>a</sup>               | 47.7                                | 105.9                        | 49.0   | 108.8  | 48.3   | 107.3                        |
| Chicken                            | 32.7                                | 105.9                        | 33.5   | 108.5  | 33.1   | 107.2                        |
| Turkey                             | 11.0                                | 107.1                        | 11.3   | 110.0  | 11.1   | 108.1                        |
| Fish                               | 12.8                                | 104.2                        | 13.1   | 106.7  | 12.8   | 104.2                        |
| Eggs                               | 29.3                                | 92.2                         | 27.9   | 87.7   | 27.9   | 87.8                         |
| Dairy Products                     |                                     |                              |        |  |        |                              |
| Creamery butter                    | 308.1                               | 91.3                         | 290.5  | 86.0   | 285.2  | 84.8                         |
| Cheddar cheese                     | 11.1                                | 74.0                         | 8.9    | 59.3   | 8.7    | 58.0                         |
| Process cheese                     | 5.7                                 | 137.4                        | 6.5    | 156.6  | 6.4    | 154.2                        |
| Other cheese                       | 6.0                                 | 124.7                        | 6.6    | 137.2  | 6.5    | 135.1                        |
| Cottage cheese                     | 6.1                                 | 169.4                        | 7.5    | 208.3  | 7.4    | 205.6                        |
| Powdered skim milk                 | 2.4                                 | 111.1                        | 2.5    | 115.7  | 2.4    | 111.1                        |
| Concen. whole milk products        | 3.6                                 | 67.4                         | 2.7    | 50.6   | 2.7    | 50.6                         |
| Concen. milk by-products           | 10.0                                | 74.8                         | 8.1    | 60.6   | 7.8    | 58.3                         |
| Fluid Milk                         | 11.3                                | 109.3                        | 11.8   | 114.1  | 11.6   | 112.2                        |
| Dairy Products                     | 238.7                               | 87.3                         | 218.8  | 80.1   | 216.5  | 79.2                         |
| Beverages                          | 784.6                               | 95.5                         | 761.3  | 92.7   | 750.8  | 91.4                         |
| tea leaf and green bean equivalent | 14.6                                | 105.9                        | 15.0   | 108.8  | 14.5   | 107.3                        |

<sup>a</sup>includes chicken, turkey, fowl, duck and goose.

TABLE 5. AGGREGATE DEMAND FOR FOOD — CANADA (1961-85)

|   | 1961    | 1970-72<br>average | 1974               | 1980<br>Without wage and price<br>controls | 1985<br>With maximum effect of<br>wage and price controls | 1985    |
|---|---------|--------------------|--------------------|--|---|---------|
|   |         |                    | — million pounds — |  |   |         |
| Cereals   | 2775.4  | 3245.3             | 3447.7             | 3616.2                                     | 3873.1  | 3870.5  |
| Sugar and Syrups                                      | 1802.0  | 2461.3             | 2142.5             | 2878.0                                     | 3155.5  | 2888.6  |
| Sugar   | 1630.6  | 2187.6             | 2061.2             | 2559.6                                     | 2805.7  | 2730.6  |
| Pulses and Nuts                                       | 301.4   | 366.9              | 459.2              | 381.2                                      | 393.8   | 406.7   |
| Fats and Oils   |         |                    |                    |  |   |         |
| Margarine   | 182.9   | 203.1              | 240.6              | 236.4                                      | 259.0   | 251.3   |
| Lard  | 155.0   | 169.6              | 168.3              | 159.2                                      | 155.4   | 178.8   |
| Shortening and shortening oils                        | 167.6   | 337.3              | 458.4              | 458.4                                      | 536.3   | 528.5   |
| Salad Oils  | 58.7    | 132.6              | 171.3              | 185.8                                      | 220.2   | 217.6   |
| Fruits  | 3149.7  | 4088.7             | 4348.5             | 4858.6                                     | 5367.9  | 5173.6  |
| Vegetables-excluding tomatoes,<br>potatoes, mushrooms | 2079.1  | 2469.0             | 2800.1             | 2812.9                                     | 3046.7  | 3013.0  |
| Tomatoes  | 1068.7  | 1274.2             | 1454.3             | 1589.8                                     | 1792.8  | 1684.0  |
| Potatoes  | 2698.3  | 3417.4             | 3420.3             | 3970.8                                     | 4342.0  | 4241.0  |
| Meat  |         |                    |                    |  |   |         |
| Beef  | 1286.7  | 1913.3             | 2126.1             | 1559.6                                     | 2966.4  | 2704.7  |
| Veal  | 124.0   | 91.9               | 78.1               | 123.0                                      | 119.2   | 116.6   |
| Mutton and lamb                                       | 63.8    | 90.5               | 57.0               | 127.0                                      | 150.3   | 134.7   |
| Pork  | 917.3   | 1351.8             | 1342.9             | 159.0                                      | 174.9   | 1694.3  |
| Poultry <sup>a</sup>                                  | 565.9   | 971.2              | 1020.6             | 1150.7                                     | 1269.4  | 1225.4  |
| Chicken   | —       | 665.7              | 695.8              | 788.9                                      | 867.9   | 839.4   |
| Turkey  | 138.6   | 221.4              | 236.4              | 265.4                                      | 292.7   | 282.4   |
| Fish  | 224.1   | 264.9              | 265.0              | 308.8                                      | 339.4   | 334.2   |
| Eggs  | 618.4   | 685.1              | 639.7              | 706.8                                      | 722.8   | 759.1   |
| Dairy Products  | 7239.4  | 7280.4             | 7558.9             | 7432.6                                     | 7526.0  | 7917.2  |
| Creamery Butter                                       | 287.8   | 323.7              | 290.2              | 267.8                                      | 230.6   | 225.4   |
| Cheddar cheese  | 52.5    | 89.5               | 117.8              | 137.5                                      | 168.4   | 165.8   |
| Process cheese  | 57.4    | 103.9              | 127.9              | 144.7                                      | 171.0   | 152.9   |
| Other cheese  | 25.5    | 77.6               | 96.3               | 147.2                                      | 194.3   | 191.7   |
| Cottage cheese  | 23.9    | 46.6               | 63.6               | 57.9                                       | 64.8  | 59.6    |
| Powdered skim milk                                    | 153.0   | 115.0              | 125.9              | 86.8                                       | 69.9  | 93.3    |
| Concen. whole milk products                           | 349.1   | 288.3              | 258.1              | 241.2                                      | 209.8   | 256.5   |
| Concen. milk by-products                              | 200.2   | 222.9              | 349.3              | 272.6                                      | 305.7   | 290.2   |
| Fluid Milk  | 6061.2  | 5893.9             | 6144.1             | 5758.4                                     | 5668.5  | 6147.7  |
| Dairy Products  | 15791.0 | 17710.1            | 17795.2            | 18927.7                                    | 19723.0   | 20171.2 |
| Beverages   | 261.0   | 297.7              | 339.2              | 352.2                                      | 388.6   | 375.7   |

<sup>a</sup>Includes chicken, turkey, fowl, duck and goose.

consumption, however, will increase because of population growth.

## SUMMARY

Continued growth in per capita consumption is indicated for sugar and syrups, fats and oils (except lard), fruits, vegetables, red meats, poultry, cheese and beverages. Decreases are projected for pulses and nuts, lard, eggs, and dairy products (except cheese). The consumption level of cereals will be stable.

The federal government's October 1975 wage and price controls were introduced with the intention of controlling inflation. The projections for per capita consumption consequently are not significantly different from those calculated without the effect of the controls (Table 4).

Total consumption of food products is calculated by applying the projected population figures to the projected per capita consumption of individual commodities for the same period (Table 5). It is estimated that except for pulses and nuts, lard, butter, powdered skim milk and fluid milk, total consumption will be higher for all commodities in 1980 and 1985.

## REFERENCES

1. Blakeslee, L.L., E.O. Heady and C.F. Framingham, World Food Production, Demand, and Trade, Ames, Iowa State University Press, 1973.

2. Hassan, Z.A. and W.F. Lu, Food Consumption Patterns in Canada, Economics Branch, Publication No. 74/8, Agriculture Canada, Ottawa, 1974.

3. FAO, Agricultural Commodity Projection, 1970-80, Vol. II, 1971, Rome.

4. FAO "Population, Food Supply and Agricultural Development", Agricultural Economics and Statistics, Vol. 23, Rome, September 1974, Monthly Bulletin.

5. Lu, W.F. and R.G. Marshall, A demand analysis for fluid milk in Ontario, University of Guelph, Publication No. AE/73/11, 1973.

6. McFarguhar A.M.M., (Editor) Europe's Future Food and Agriculture, ASEPELT, Vol. III, Amsterdam, 1971.

7. Organization for Economic Co-operation and Development (O E C D), Agriculture Projections for 1975 and 1985: Europe, North America, Japan and Oceania, Paris, 1968.

8. Statistics Canada, Population Projections for Canada and the Provinces, 1972-2001, Catalogue 91-514, Ottawa, June 1974.

9. Yankowsky, Z.J. *et al.*, Demand - Supply Projections for Canadian Agriculture - 1980, Economics Branch, Canada Department of Agriculture, Ottawa, June, 1968.

10. Yankowsky, Z.J., "A Note on Long-Term Agricultural Demand Projections", Canadian Farm Economics, Canada Department of Agriculture, Vol. 1, No. 5, Ottawa, Dec. 1966 pp. 12-16.

# THE INCREASE OF PALM OIL IN WORLD MARKETS



J.W. Duncker\*

*World production and exports of palm oil have recently shown a rapid increase which is likely to continue. From 1975 to 1980 production could rise by 50 percent. Exports may at least double during the same period. By 1980, more than half of the world production of palm oil will come from Malaysia, with Indonesia and the Ivory Coast showing continued growth.*

## INTRODUCTION

World production of palm oil could increase by 50 percent from 1975 to 1980 to 8 percent of the world production of fats and oils. World exports might more than double during the same period to about 20 percent of total world exports. In 1980 Malaysia will account for more than half of the world production of palm oil. Its export share could be about 75 percent. Indonesia and the Ivory Coast will continue to show strong growths in production. Canadian palm oil imports will likely increase further if rapeseed and soybean oil prices rise again from present low levels. However, utilization will be limited mainly to shortening and margarine oils, as is the case in the United States.

## THE OIL PALM AND ITS PRODUCTS

The oil palm is indigenous to the tropical areas of West Africa. It is generally confined to the lowland areas of the humid equatorial regions of the world. Therefore, suitable growing conditions also occur in parts of Southeast Asia, South and Central America and Central and East Africa.

Palm oil is obtained from the outer fleshy pulp of the palm fruit. The kernel contains the palm kernel oil and provides palm kernel meal as a residue.

In the newer varieties the ratio of palm oil output to palm kernel output is nearly 10 to 1, which makes palm oil the dominant product. However, it has to be produced "on the spot" because of the perishability of the fruit pulp, whereas palm kernels are storable. Palm oil and kernel oil have a different chemical composition. Palm kernel oil resembles coconut oil in physical properties. Together they are called lauric oils because they share a saturated fatty acid called lauric acid.

The oil palm normally produces sufficient fruit to warrant harvesting about the third year following planting. Yields increase rapidly until the seventh year. Then the growth rate slows, with yields peaking at 10 years (Table 1). At 25 years of age, the oil palm still produces about 80 percent of its peak yields. However,

**TABLE 1. YIELD CHANGES IN THE OIL PALM ON GOOD OIL PALM SOILS IN MALAYA**

| Year of Harvest             | Yield tonnes per acre of fruit bunches |
|-----------------------------|--|
| 1 (2-3 years from planting) | 2                                      |
| 2                           | 4.5 - 5                                |
| 3                           | 7 - 8                                  |
| 4                           | 8 - 9                                  |
| 5                           | 9 - 10                                 |
| 6                           | 10 - 11                                |
| 7                           | 10 - 11                                |

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Source: "Oil palm cultivation in Malaya" U.N. of Malaya press.

since the tree size after that age makes harvesting increasingly difficult, the economic life of the tree is about 25 years.

## PRODUCTION

World palm oil production has increased steadily during the last 8 years. Since 1967 the average annual growth rate has been about 10 percent because of area expansion and to a lesser extent increased productivity. West Malaysian production accounted for 18 percent of world production in 1967 and more than 40 percent this year. In 1974, production there increased by more than 25 percent above year-earlier levels to 930,000 tonnes (metric). Production advanced in the first half of 1975 by more than 30 percent and was expected to reach 1,150,000 tonnes in 1975. East Malaysian and Indonesian production also increased. In East Malaysia production may have reached 125,000 tonnes, an increase of 42 percent compared with 88,000 tonnes in 1974 and only 38,000 tonnes in 1971. Indonesian production is increasing moderately. Spurred by favorable markets, processing capacity and well-organized production, annual output increases during the last few

years have been approximately 10 percent, about 370,000 tonnes in 1975. In West Africa only the Ivory Coast has a dynamic production pattern. In 1975, palm oil production was expected to reach 160,000 tonnes compared with an estimated 145,000 in 1974 and 55,000 in 1971. In contrast, Zaire, which accounted for more than 18 percent of total world production in 1960, accounted for only about 7 percent in 1974. Zaire's production has declined since 1970 from 201,000 to 174,000 tonnes in 1974. Nigerian production increased to only 483,000 tonnes in 1974 from 457,000 tonnes in 1970 (Table 2).

The different palm oil production patterns of the two main regions, Southeast Asia and West Africa, require further scrutiny.

## PALM OIL DEVELOPMENTS IN AFRICA

Palm oil fruits have long been processed on a small scale in West Africa which was until recently the only palm oil producing area. Much of the crop is still harvested from wild groves and the palm oil produced is destined for local consumption. Commercial production has been

TABLE 2. WORLD PRODUCTION OF PALM OIL AND PALM KERNELS (OIL EQUIVALENT)<sup>a</sup>

|  | 1971         |             | 1972         |             | 1973         |             | 1974         |             | 1975 <sup>b</sup> |             |
|--|--------------|-------------|--------------|-------------|--------------|-------------|--------------|-------------|-------------------|-------------|
|  | Palm Oil     | Palm Kernel | Palm Oil     | Palm Kernel | Palm Oil     | Palm Kernel | Palm Oil     | Palm Kernel | Palm Oil          | Palm Kernel |
| — '000 tonnes —                            |              |             |              |             |              |             |              |             |                   |             |
| Nigeria                                    | 432          | 144         | 457          | 139         | 432          | 115         | 483          | 143         | 483               | 143         |
| Zaire                                      | 190          | 56          | 190          | 49          | 185          | 41          | 74           | 36          | 165               | 35          |
| Ivory Coast                                | 55           | 6           | 93           | 10          | 111          | 12          | 145          | 12          | 155               | 16          |
| Other                                      | 326          | 146         | 327          | 136         | 333          | 133         | 333          | 134         | 337               | 139         |
| <b>TOTAL AFRICA</b>                        | <b>1,010</b> | <b>352</b>  | <b>1,067</b> | <b>334</b>  | <b>1,061</b> | <b>301</b>  | <b>1,135</b> | <b>325</b>  | <b>1,140</b>      | <b>333</b>  |
| West Malaysia (Sabah)                      | 551          | 56          | 659          | 64          | 740          | 73          | 932          | 99          | 1,150             | 113         |
| East Malaysia                              | 38           | 3           | 72           | 7           | 76           | 6           | 88           | 6           | 125               | 9           |
| Indonesia                                  | 248          | 26          | 269          | 28          | 290          | 30          | 351          | 31          | 370               | 33          |
| <b>TOTAL SOUTHEAST ASIA</b>                | <b>837</b>   | <b>85</b>   | <b>1,000</b> | <b>99</b>   | <b>1,106</b> | <b>109</b>  | <b>1,371</b> | <b>136</b>  | <b>1,645</b>      | <b>155</b>  |
| <b>OTHER (South &amp; Central America)</b> | <b>67</b>    | <b>24</b>   | <b>76</b>    | <b>24</b>   | <b>86</b>    | <b>24</b>   | <b>88</b>    | <b>23</b>   | <b>100</b>        | <b>23</b>   |
| <b>WORLD TOTAL</b>                         | <b>1,914</b> | <b>461</b>  | <b>2,253</b> | <b>457</b>  | <b>2,253</b> | <b>434</b>  | <b>2,594</b> | <b>484</b>  | <b>2,885</b>      | <b>511</b>  |

<sup>a</sup>adapted from various U.S.D. A. publications.

<sup>b</sup>estimate.

channelled increasingly to domestic industries, rather than to exports, for the manufacture of table oils, soaps and, to a lesser extent, shortenings and margarine. Production for the international market is slowly being developed. Exports rely heavily on the plantation system and on production cooperatives that supply centrally located processing mills equipped with port bulk facilities. However, in Nigeria, a growing population and civil war virtually eliminated the export trade. Domestic consumption in Nigeria is expected to increase with production gains. In Zaire also, political instability interrupted replanting. Shortages of labor for harvesting and maintenance operations have interrupted the vital continuity and regularity of the production processes. Other problems are high internal transport costs and the numerous small-holders who do not serve the commercial market. Recent export decline is also partly due to increased domestic industrial utilization. Further development will require investment in new processing facilities and government incentives. The Zaire government favors the domestic market. The existing oil mill capacity is outmoded, the remaining old trees are past their peak and harvesting is becoming increasingly difficult. Plans are being put into effect to revive the industry. However, even under favorable conditions increased production will not occur until the early eighties.

In contrast, the Ivory Coast bases its production on modern, large-scale production techniques and export shipments have risen although domestic utilization has increased.

In summary, West African palm oil exports that totalled 400,000 tonnes in 1960 have declined because of expanding domestic markets, decreased operational efficiency, production disruptions, and fewer investments. The production lag after the return-to-normal circumstances in addition to the dominant small-scale production has left, with some exceptions, little for export.

## PALM OIL DEVELOPMENTS IN MALAYSIA

Production in South Asia, in particular Malaysia, has become the dominant source of palm oil supply since the early sixties. The strong production increase, due to area expansion and increased yields in Malaysia, has been favored by a set of factors which include:

- suitable soils
- available land on which rubber trees were once planted as a result of a decreased demand in world markets for natural rubber

- improved high-yielding palm varieties
- Malaysia's long experience with perennial tree crop culture and the plantation system
- the availability of cheap labor. The Malaysian government is involved with the settlement and assistance of landless families on virgin soil
- financial cooperation between powerful (often foreign) corporations and the Malaysian government to cover, among other things, the heavy initial expense
- the modern planning approach. In Malaysia planning is done mainly through "five-year plans"
- government assistance with scientific, technical, and economic research and advice
- the economies of scale of large-estate production
- the provision of an adequate infra-structure not only related to estate production and processing but also to transportation and exporting
- the production for international markets where the relatively low-cost price per unit of output of Malaysian palm oil and the substitutability of palm oil for other oils are decided sales advantages.

The low-cost price per unit of palm oil results from both relatively low labor costs and the remarkable productivity per acre of cultivated land compared with that of other oil crops (Table 3).

**TABLE 3. COMPARISON OF AVERAGE YIELDS OF SOME OILSEED CROPS BY COUNTRY**

| Oil Crop       | Country       | Year | lb/ac |
|----------------|---------------|------|-------|
| Palm Oil       | West Malaysia | 1971 | 3,600 |
| Peanut Oil     | United States | 1973 | 725   |
| Coconut Oil    | Philippines   | 1972 | 625   |
| Sunflower Oil  | U.S.S.R.      | 1973 | 530   |
| Rapeseed Oil   | Canada        | 1972 | 360   |
| Soybean Oil    | United States | 1973 | 300   |
| Cottonseed Oil | United States | 1973 | 150   |

Source: G.W. Kromer, "Palm Oil in the World's Fats and Oils Economy", U.S.D.A.

The Malaysian area under palm oil production increased from 135,900 acres in 1960 to 1,030,000 in 1973 and 1,480,000 in 1975 with 62 percent of the crop consisting of mature trees. The crop ranks third after rubber and paddy in land utilization. The federal land development authority is mainly responsible for the phenomenal growth of oil palm utilization. This authority undertakes the initial clearing of the land and

the planting. Settlers are not introduced until the basic infra-structure is completed.

The extension of oil palm cultivation has been spectacular during the first and second Malaysian plans:

|                   | Oil Palm Area as a Percentage of Land Development* |          | Area in Oil Palm |          |
|-------------------|--|----------|------------------|----------|
|                   | planned  | achieved | planned          | achieved |
|                   | — % —  |          | — '000 acres —   |          |
| 1966–70 . . . . . | 73   | 74       | 103              | 133      |
| 1971–75 . . . . . | 50   | 70       | 202              | 224      |

\*By the Federal Land Development Authority (FELDA).

Realized oil palm plantings exceeded planned oil palm plantings both absolutely and relatively. Future area expansion will depend on official encouragement of long-term crop diversification. Malaysia has the potential to increase production. However, although Malaysian costs per unit of output are relatively low, international price behavior of edible oils is an influential factor in production planning.

## COST STRUCTURE OF ESTATE PRODUCTION, TRANSPORTATION AND ECONOMIC IMPLICATIONS

Commercial oil palm cultivation is a capital-intensive operation. The preparation of the land, (which involves felling and clearing, the installation of drainage works, weeding, manuring and pest control), further planting, upkeep, and soil conservation all require an investment of close to \$1,500 per acre. Also, the extraction plants demand heavy capital outlay. Processing capacity for 15 tonnes of "fresh fruit bunches" an hour requires an investment of about \$4 million. This capacity is generally sufficient to process the continuous harvest of a plantation of almost 6,000 acres. An investment of between \$1.5 and \$2 million is necessary for auxiliary buildings, housing, water and electricity. Additional costs of about \$1 million go towards agricultural equipment, road development and vehicles, since the perishability of the palm fruit necessitates speedy processing and rapid transportation.

Therefore, the average capital requirements for an estate of about 6,000 acres amount to almost \$15 million or \$2,500 per acre<sup>1</sup>. However, the annual average output

per acre is 3,600 pounds of palm oil which is much higher than the equivalent figures for any oilseed (Table 3). As a result, the fixed costs of palm oil are still only 1 to 2 cents per pound if capital costs are depreciated over a 25-year period. Variable costs would add about 6 to 7 cents. Therefore, the cost price per pound of palm oil would be about 8 cents<sup>2</sup>. However, these calculations have not been based on up-to-date evidence. Malaysian palm oil can be produced under more modern conditions for as little as 4 cents per pound.

Transportation beyond the palm oil mill is increasingly served by modern tank trucks via improved roads to new port areas with modern bulk storage complexes. The use of new rapid ocean tankers is becoming more widespread to transport palm oil to overseas destinations. The large initial capital investments in plantation processing mills, infra-structure and transportation equipment, the time lag between planting and first harvesting, the long production cycle of the oil palm tree, the high productivity per acre planted, and the comparatively low variable production costs, all make palm oil supply relatively inelastic to short-term changes in world demand and or price changes. As long as the export pricing of palm oil covers the relatively low variable costs (labor, maintenance, etc.) and at least part of the capital costs (depreciation), there will be an incentive to produce palm oil from existing and newly matured capacity. As a result, palm oil supply and export shipments might still increase although the world situation indicates that there is an oversupply of fats and oils and that prices are at low levels or declining. Conversely, palm oil production and supply will react with considerable delay to attractive world price levels of fats and oils. Therefore, commercial palm oil culture can have an aggravating cyclical effect.

## PALM OIL AND THE COMPETING EDIBLE OILS

### Share of World Production and Exports

World palm oil production and exports have been stimulated by relatively low pricing because of relatively low costs. The palm oil share of edible oils increased in an expanding world market from about 7.4 percent during 1970-71 to about 8.9 percent during 1974-75. The further relative share increase during 1975-76 is small because the output of edible oils from other sources, particularly from the soybean crops in the United States and Brazil, greatly increased (Table 4).

<sup>1</sup> Expressed in Malaysian currency (1 Malaysian dollar = .40 U.S. dollars).

<sup>2</sup> Expressed in U.S. currency.

TABLE 4. EDIBLE OILS (OIL EQUIVALENT) WORLD PRODUCTION

|                             | 1970-71            |       | 1974-75            |       | 1975-76            |       |
|-----------------------------|--------------------|-------|--------------------|-------|--------------------|-------|
|                             | — '000<br>tonnes — | %     | — '000<br>tonnes — | %     | — '000<br>tonnes — | %     |
| Cottonseed Oil              | 2,400              | 9.8   | 2,900              | 9.4   | 3,000              | 8.9   |
| Peanut Oil                  | 3,300              | 13.6  | 3,020              | 9.8   | 3,100              | 9.2   |
| Soybean Oil                 | 6,100              | 25.0  | 10,000             | 32.2  | 12,000             | 35.7  |
| Sunflower Oil               | 3,250              | 13.3  | 4,000              | 12.9  | 3,500              | 10.4  |
| Rapeseed Oil                | 2,000              | 8.2   | 2,400              | 7.8   | 2,600              | 7.7   |
| (Canada share)              | ( 622)             | (2.5) | (442)              | (1.4) | (615)              | (1.8) |
| Coconut and Palm Kernel Oil | 2,700              | 11.1  | 2,900              | 9.4   | 3,300              | 9.8   |
| Palm Oil                    | 1,800              | 7.4   | 2,750              | 8.9   | 3,100              | 9.2   |
| Fish Oil                    | 1,300              | 5.4   | 1,150              | 3.7   | 1,300              | 3.9   |
| Other                       | 1,520              | 6.2   | 1,830              | 5.9   | 1,750              | 5.2   |
| TOTAL                       | 24,370             | 100.0 | 30,950             | 100.0 | 33,650             | 100.0 |

Sources: U.S.D.A. and "Oil World".

The increase in world exports of palm oil is even more significant. From 1970-71 to 1974-75, the share of palm oil in world export shipments of edible oils increased from 10.1 to 14.1 percent. The share decrease in 1975-76 would be temporary as it is mainly due to the abundant soybean availabilities in the United States and Brazil in that crop year (Table 5).

#### The Economic Significance of the Physical Properties of Palm Oil and Palm Kernel Oil (as compared with other edible oils)

Palm oil contains an almost equal balance of saturated and unsaturated fatty acids, whereas in palm kernel oil and in coconut oil, saturated fatty acids are very dominant (especially lauric acid). They are called lauric oils.

Palm oil has a high melting point (about 43°C) which makes it unsuitable for salad oils. It is used in shortening oils and, to a lesser extent, in margarine oils. It is also used in soap and cosmetics and as an industrial lubricant. Palm kernel oil melts at lower temperatures but still above room temperature. Its edible uses are therefore virtually limited to shortening oils and confectionery. Its melting properties are especially useful in chocolate. Because this oil is resistant to rancidity, it adds a long shelf-life to confectionery.

Consequently, the economic advantages of the large productivity of the palm oil estate and the relatively low-cost price per unit of palm oil output are offset to a certain extent by the more limited uses of this oil compared with soybean oil in particular. Palm kernel oil has other uses, although they are also limited. Trans-

TABLE 5. EDIBLE OILS (OIL EQUIVALENT) WORLD EXPORTS

|                 | 1970-71          |       | 1974-75          |       | 1975-76          |       |
|-----------------|------------------|-------|------------------|-------|------------------|-------|
|                 | — '000<br>tonnes | %     | — '000<br>tonnes | %     | — '000<br>tonnes | %     |
| Fish Oil        | 690              | 7.7   | 600              | 5.9   | 650              | 5.3   |
| Peanut Oil      | 770              | 8.6   | 725              | 7.1   | 825              | 6.7   |
| Soybean Oil     | 2,950            | 33.0  | 3,700            | 36.0  | 5,200            | 42.4  |
| Sunflower Oil   | 770              | 8.6   | 650              | 6.3   | 450              | 3.7   |
| Rapeseed Oil    | 650              | 7.3   | 720              | 7.0   | 820              | 6.7   |
| (Canada share)  | (403)            | (4.5) | (225)            | (2.2) | (405)            | (3.3) |
| Coconut Oil     | 1,250            | 14.0  | 1,300            | 12.7  | 1,500            | 12.2  |
| Palm Kernel Oil | 230              | 3.7   | 410              | 4.0   | 460              | 3.7   |
| Palm Oil        | 900              | 10.1  | 1,450            | 14.1  | 1,650            | 13.4  |
| Other Oil       | 625              | 7.0   | 710              | 6.9   | 730              | 5.9   |
| TOTAL           | 8,935            | 100.0 | 10,265           | 100.0 | 12,285           | 100.0 |

Source: U.S.D.A. and "Oil World".

portation requirements are an additional cost factor concerning edible oils.

### Pricing

Because of increasing supply and more limited uses, palm oil prices have been below soybean oil and rapeseed prices since 1970. Palm kernel oil moves in conjunction only with coconut oil. The different uses of the lauric oils (palm oil plus coconut oil) are mainly responsible for their different price developments (Table 6).

Towards the end of 1974, oil prices declined. This decline continued into 1975 because of several factors: consumer resistance to high pricing, a recession in the economy and increasing supplies of edible oils. As the economic situation became worse, competitive pricing of palm and lauric oils played an increasingly important role. This competition affected the pricing of soybean oil during the second half of 1975. Towards the end of that year the price difference between soybean oil and the tropical oils was substantially reduced.

At present low-price levels, soybean oil is again competitive. This fact is being reinforced because a palm oil price decrease seems to be resisted by the palm oil producers. Therefore, further market penetration of palm and lauric oils will likely be limited (Table 7 and Figure 1).

**TABLE 6. ANNUAL MARKET PRICES OF EDIBLE OILS**

|   | 1971 | 1972 | 1973 | 1974 | 1975 |
|---|------|------|------|------|------|
| — ¢ per lb —  |      |      |      |      |      |
| Soybean Oil<br>any origin; crude<br>oil Dutch, f.o.b. mill            | 13.8 | 11.1 | 19.7 | 37.8 | 27.4 |
| Rapeseed Oil<br>Dutch f.o.b. mill                                     | 13.4 | 10.5 | 18.5 | 33.8 | 23.9 |
| Coconut Oil<br>Dutch Max 5% f.o.b. mill                               | 16.0 | 11.2 | 22.7 | 44.1 | 18.8 |
| Palm Kernel Oil<br>West African<br>c.i.f. <sup>a</sup> European Ports | 15.2 | 11.0 | 21.6 | 47.6 | 21.0 |
| Palm Oil<br>Malayan 5%<br>c.i.f. European Ports                       | 11.9 | 9.8  | 17.1 | 30.4 | 20.2 |
| Peanut Oil<br>Nigerian 3.5%<br>c.i.f. European Ports                  | 20.2 | 19.3 | 24.7 | 49.0 | 40.4 |
| Sunflowerseed Oil<br>and origin Rotterdam                             | 17.0 | 14.8 | 21.9 | 44.6 | 35.1 |

<sup>a</sup>cost insurance and freight.

Sources: UNCTAD "Monthly Commodity prices", and "Oil World" Selected Oil Prices.

**TABLE 7. MONTHLY MARKET PRICES, 1975, EDIBLE OILS**

|   | Jan. | Feb. | Mar. | Apr. | May  | June | July | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|------|------|------|------|------|------|------|------|-------|------|------|------|
| — ¢ per lb —                                      |      |      |      |      |      |      |      |      |       |      |      |      |
| Soybean Oil<br>Crude Dutch                        | 35.1 | 30.0 | 28.2 | 28.3 | 23.4 | 23.8 | 26.2 | 27.2 | 25.0  | 22.5 | 19.2 | 17.7 |
| Rapeseed Oil<br>Dutch f.o.b.                      | 34.9 | 30.0 | 27.5 | 28.3 | 22.9 | 21.6 | 25.2 | 26.8 | 24.9  | 22.1 | 18.6 | 17.0 |
| Coconut Oil<br>Phil/Indonesia<br>c.i.f. Rotterdam | 24.9 | 21.2 | 20.4 | 19.4 | 16.1 | 15.1 | 16.9 | 17.6 | 16.7  | 15.7 | 14.8 | 15.4 |
| Palm Kernel Oil<br>Dutch f.o.b.                   | 27.0 | 22.9 | 22.0 | 20.0 | 16.6 | 15.6 | 17.0 | 17.4 | 16.3  | 15.7 | 15.5 | 16.4 |
| Palm Oil Sumatra/<br>Malaysia<br>5% Bulk c.i.f.   | 25.0 | 20.9 | 20.4 | 19.9 | 17.1 | 15.1 | 17.6 | 20.5 | 18.9  | 18.6 | 17.9 | 16.8 |
| Peanut Oil<br>Nigeria Bulk                        | 48.9 | 48.9 | 43.8 | 40.0 | 33.0 | 29.9 | 36.9 | 41.2 | 39.5  | 38.1 | 34.2 | 32.3 |
| Sunflowerseed Oil,<br>Rotterdam                   | 48.9 | 43.5 | 34.5 | 35.6 | 30.2 | 25.9 | 29.7 | 33.3 | 30.9  | 30.3 | 29.8 | 29.5 |

Sources: UNCTAD "Monthly Commodity Prices", and "Oil World" Selected Oil Prices.

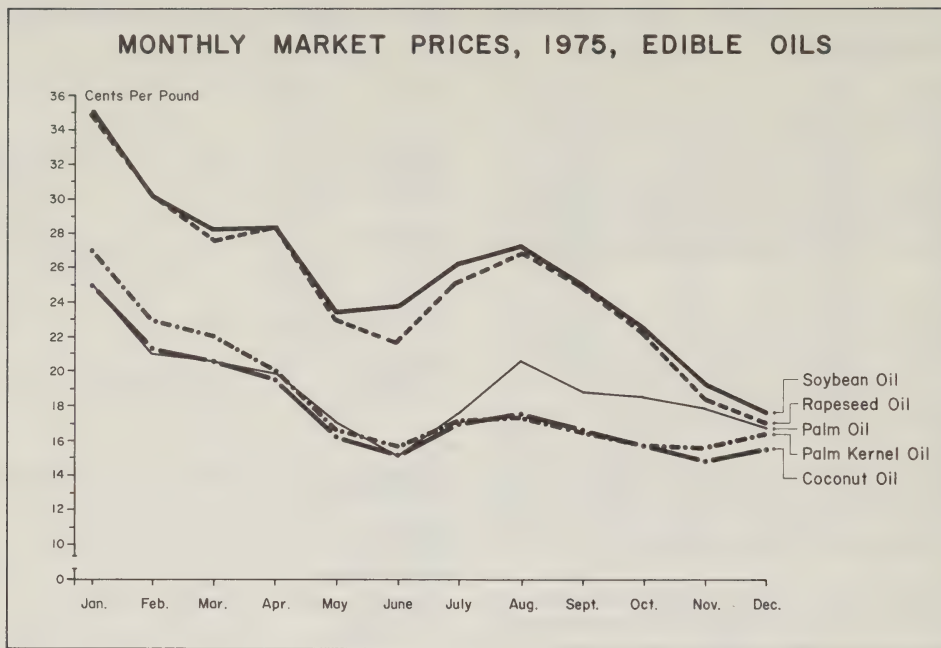


Figure 1

\*The data from Table 7 was used.

## WORLD EXPORTS: ORIGIN AND DESTINATION

World exports of palm oil which increased only from 597,000 tonnes in 1960 to 740,000 in 1970, increased to almost 1,500,000 in 1974. The significant production gains were largely in the Southeast Asian countries and were virtually all exported. In contrast, West African exports remained nearly unchanged during the last few years. The Ivory Coast alone enlarged its still modest export volume. The Southeast Asian export volume in 1975 was about 10 times that in Africa the same year. West Malaysian export shipments (greater than 800,000 tonnes) represented more than 60 percent of world export trade in 1974. The shipments were about 12 percent above those in 1973. The gain in 1975 is estimated to have been much higher. In comparison, the exports and export gains of East Malaysia (Sabah) and Indonesia are relatively modest. East Malaysian exports reached about 90,000 tonnes and Indonesian exports approximately 280,000 in 1974. In West and East Malaysia domestic palm oil consumption is virtually negligible, and it is less than 10 percent of the production in Indonesia.

World exports of palm kernels (oil basis) and palm kernel oil are modest in comparison with exports of palm oil. In 1974 they totalled 350,000 tonnes, only 25 percent of the world trade in palm oil, compared with 60 percent in 1966. This difference is mainly due to the newer high-yielding varieties of African oil palm in West Malaysia which yield more palm oil compared with palm kernels than do older varieties. World exports of palm kernel nuts have declined since the decreased exports of the African countries have not been compensated for by shipments from Southeast Asia. A palm kernel crushing industry has been established in West Malaysia with a processing capacity which can more than meet the domestic supply of palm kernels (Table 8).

About 30 percent of Malaysian exports went to Singapore. From there, large quantities were re-exported to the United Kingdom and Continental Europe. The remainder was shipped to the United States (12%), the United Kingdom (13%), the Netherlands (11%), Iraq (10%), West Germany (5%) and India (5%). The Netherlands re-exports a large amount to other countries of the European Economic Community (E E C). West Malaysian exports to the United States, West Germany and

TABLE 8. WORLD EXPORTS OF PALM OIL<sup>a</sup> AND PALM KERNEL (OIL AND OIL BASIS)

|                                    | 1971         |              | 1972           |              | 1973           |              | 1974           |              | 1975 <sup>b</sup> |             |
|------------------------------------|--------------|--------------|----------------|--------------|----------------|--------------|----------------|--------------|-------------------|-------------|
|                                    | Palm Oil     | Palm Kernel  | Palm Oil       | Palm Kernel  | Palm Oil       | Palm Kernel  | Palm Oil       | Palm Kernel  | Palm Oil          | Palm Kernel |
| — '000 tonnes —                    |              |              |                |              |                |              |                |              |                   |             |
| Nigeria                            | 20.2         | 140.0        | 1.9            | 133.3        | —              | 104.5        | —              | 122.2        | —                 | 120         |
| Zaire                              | 111.9        | 44.9         | 87.0           | 37.3         | 69.7           | 32.8         | 62.0           | 34.0         | 50                | 30          |
| Ivory Coast                        | 28.0         | 9.1          | 47.6           | 9.6          | 55.0           | 23.8         | 101.6          | 18.0         | 140               | 20          |
| Other                              | 40.8         | 102.7        | 26.8           | 72.2         | 17.7           | 57.5         | 32.2           | 69.1         | 40                | 70          |
| <b>TOTAL AFRICA</b>                | <b>200.9</b> | <b>296.7</b> | <b>163.3</b>   | <b>252.4</b> | <b>142.4</b>   | <b>218.6</b> | <b>195.8</b>   | <b>243.3</b> | <b>230</b>        | <b>240</b>  |
| West Malaysia                      | 531.1        | 12.3         | 624.9          | 49.6         | 724.6          | 66.2         | 812.0          | 92.3         | 1,000             | 110         |
| East Malaysia<br>(Sabah)           | 38.1         | 3.5          | 71.7           | 6.4          | 72.9           | 5.7          | 87.9           | 9.3          | 127               | 11          |
| Indonesia                          | 187.5        | 20.9         | 231.7          | 23.0         | 257.7          | 29.1         | 281.8          | 27.4         | 305               | 30          |
| <b>TOTAL SOUTHEAST ASIA</b>        | <b>756.7</b> | <b>36.7</b>  | <b>928.3</b>   | <b>79.0</b>  | <b>1,055.2</b> | <b>101.0</b> | <b>1,181.7</b> | <b>129.0</b> | <b>1,432</b>      | <b>151</b>  |
| OTHER<br>(South & Central America) | 5.3          | 74.0         | 2.2            | 4.9          | 5.6            | 6.0          | 5.7            | 6.9          | 6                 | 6           |
| <b>WORLD TOTAL</b>                 | <b>963.1</b> | <b>340.8</b> | <b>1,093.9</b> | <b>336.3</b> | <b>1,203.0</b> | <b>325.6</b> | <b>1,383.2</b> | <b>379.2</b> | <b>1,668</b>      | <b>397</b>  |

<sup>a</sup>adapted from various U.S.D.A publications.<sup>b</sup>estimate.

India have become significant only during the last few years. Exports to Canada have fluctuated between 10,000 and 20,000 tonnes since 1966. In that year, palm oil exports from Indonesia were roughly equivalent to West Malaysian shipments. However, Indonesian exports developed at a much slower rate to reach a total volume of 260,000 tonnes in 1973. The increase resulted in more shipments to the United States (from 26,900 tonnes in 1966 to 73,600 in 1973), and to Japan (from 19,600 to 51,800 tonnes). The Netherlands, the other major recipient of Indonesian palm oil, has received a comparatively constant volume of 50,000 to 60,000 tonnes since 1966. The exporting African countries, the Ivory Coast and Zaire, ship almost exclusively to the EEC countries. Nigeria, once the major exporter of more than 150,000 tonnes in 1966, virtually ceased exports in 1968.

## WORLD IMPORTS: DISTRIBUTION

The major areas of palm oil consumption are the highly developed industrial areas. Of world exports totalling 1,200,000 tonnes in 1973, the EEC (six) absorbed 450,000 (37%), the United Kingdom 240,000 (20%), the United States 175,000 (15%), and Japan 100,000 (8%). World palm oil imports doubled from 1966 to 1973. In

1966 the share to the EEC was 49 percent, the United Kingdom 26, the United States 6, and Japan 2.4. Consequently, markets in the two latter countries have increased in relative importance. Both markets grew at about the same rate to increase their combined share of global palm oil imports from 10 to 23 percent. The imports of the established markets in the United Kingdom and Continental Europe decreased from 75 percent of world imports in 1966 to 57 percent in 1973.

In 1966 about 60 percent of total United Kingdom imports came from Nigeria. In 1973 most of the imports came directly from Malaysia or through Singapore. They increased by more than 60 percent from 1966 to 1973 to reach 244,000 tonnes or close to 20 percent of world imports in 1973.

The rise in the United States' palm oil imports results from the increased availability of the oil in South Asia. Imports quintupled from 1966 to 1973 to 176,000 tonnes because of more shipments from Indonesia and West Malaysia. The United States' share of world palm oil imports increased from 6 to 15 percent.

The sizeable imports of the Netherlands have traditionally come from Indonesia and to a lesser extent from

West Africa. The African shipments have remained almost unchanged, with those from the Ivory Coast and Zaire replacing Nigeria's. The growth in imports from Southeast Asia are entirely due to direct and indirect shipments from West Malaysia and Singapore. West Germany replaced diminishing imports from Nigeria and Zaire with shipments from West Malaysia and, to a lesser extent, from the Ivory Coast.

The EEC countries (six) represent a growing market for Malaysian palm oil because of decreased shipments from West Africa and increased consumption of fats and oils. Malaysian shipments to the United States tended to fluctuate according to the United States' domestic availability of edible oils. However, imports which were equivalent to 6 million bushels (oil bases) of soybeans in 1967 increased to the equivalent of 21 million in 1971 and have totalled about 60 million in 1975. This would be about 10 percent of the domestic consumption of edible oils in the United States in 1975.

### PALM OIL IN CANADA

In Canada, palm oil is used extensively in the production of shortening oils and, to a lesser degree, margarine oils. The proportion used in the production of these vegetable oils fluctuates yearly because of changes in relative prices of oils. Palm oil made up about 8.6 percent of the oils used in 1972, less than 5 percent in 1974, but increased to 9 percent in the first half of 1975 because of relatively lower prices. There was a sharp increase of palm oil in the production of shortening oils. Variations in its utilization for the production of margarine oils are much less significant. Palm kernel oil is used in smaller quantities and exclusively in shortenings.

Consequently, Canadian imports of palm oil and palm kernel oil declined during 1973 and the first half of 1974. They increased strongly during the second half of 1974 and during 1975. In the first half of 1975, palm oil imports increased to almost 28 percent of total vegetable oil imports, a larger share than for any other imported vegetable oil.

During the last five years, shipments of palm oil mainly came directly from Malaysia or through Singapore and the United States. However, during 1974 and 1975, shipments from Indonesia became more prominent.

All Canadian imports of palm kernel oil originated in Malaysia because shipments from West Africa ceased in 1974 and 1975. Imports of crude palm oil and palm kernel oil enter Canada as well as the United States duty free.

### SUMMARY

The increased supply of palm oil in world markets has resulted primarily from increased plantings, high productivity and low-cost production in West Malaysia. Low production costs contribute to palm oil being priced low in relation to other oils in world markets. The relatively low sales prices have more than offset the physical disadvantages of the oil.

World production and exports will likely continue to grow because of the supply pressure of existing production capacity and maturing capacity.

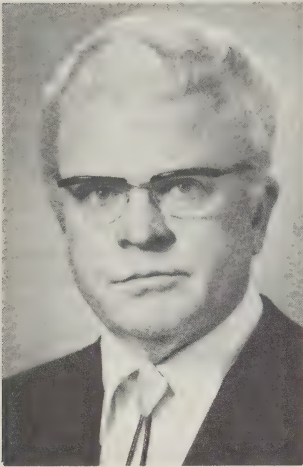
However, the competitive advantage has declined recently because of the price decrease of competing oils. Under more normal supply circumstances, growth potential would exist in established markets and in the markets in India, China, West Asia and the U.S.S.R. where there is a high population growth rate and/or where consumption rates are low. A relatively low palm oil price is an advantage in low-income countries with high demand elasticities.

### LIST OF REFERENCES

1. Foreign Agriculture Circular, (FO 8-74 October 1974) (FO 5-76 June 1975).
2. Economic Report, 1974-1975, The Treasury, Malaysia.
3. Oilseeds Situation and Outlook, Bureau of Agricultural Economics, Canberra Australia, 1975.
4. Palm oil in the World's Fats and Oils Economy, George W. Kromer, U.S.D.A., Sept. 30, 1974.
5. An Evaluation of the Return of Investment of Planting 5,000 Acres of Jungle Land with Oil Palm. Review of Agricultural Economics, FAMA, Vol. 3, No. 2, December 1969.
6. Oil Palm Cultivation in Malaya, University of Malaya Press, Kuala Lumpur, 1970, C.N. Williams and Y.C. Hsu.
7. The Establishment and Operating Costs of a 40-ton-per-hour Palm Oil Mill in West Malaysia, Case Study - Chan Wing Palm Oil Mill, Enche Roslan Abdullah.
8. FAO February 1975 Committee on Commodity Problems, Intergovernmental Group on Oilseeds, Oils and Fats:

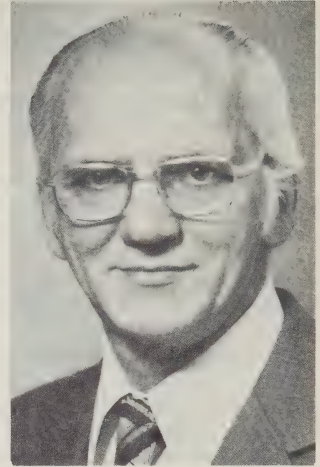
- (1) Land use research and development for lauric oils and palm oil: a follow-up note; 1974, July 1, 1974, October 7, 1974, and August 1, 1975.
- (2) Oilseeds and vegetable oils: review of national policies and plans; Nigeria, Philippines, Senegal, India, and Malaysia.
9. Foreign Agriculture, USDA, May 1, 1972, April 1972, Sept. 4, 1972, August 27, 1973, March 18, 1974.
10. Report from the Commercial Officer, Kuala Lumpur, Dept. of Industry, Trade and Commerce, December 4, 1975.
11. Tropical Products Quarterly, September 1975.

# CANADA'S PASTURE POTENTIAL



*High world grain prices in recent years have increased interest in the production and feeding of forage to livestock. One potential source of forage to replace grains in cattle feeding is new pasture land. The authors say that the most practical pasture potential, in economic terms, lies in the Prairie region where about 22 million acres of range and marginal cropland could feasibly be converted to improved pasture.*

A. Johnston and S. Smoliak \*



## INTRODUCTION

High grain prices throughout the world have created new interest in the use of more forage and less grain in beef production. A recent Food Prices Review Board report<sup>1</sup> suggests that producers and consumers throughout the world can benefit from increased use of forage in cattle feeding. Since pasture forage can be produced on lands unsuitable for cultivated crops, the question arises, "What is Canada's pasture potential?" This article discusses pasture potential in the various parts of the country and suggests the areas holding the most promise.

## HISTORICAL PERSPECTIVE

When the Europeans first came to North America, the deciduous forest of the east stretched from the Gulf of Mexico to Ontario, and the Boreal Forest of the north from Newfoundland to Alaska. Wild grazing animals were confined mostly to the central prairies and to the plateaus and mountain valleys of the far west.

In Canada, part of the eastern forest was cleared and agriculture was established in the Atlantic provinces, southern Quebec, and southern Ontario. Agriculture in the prairies after Confederation was an extension of that

in Ontario, although a distinctive agriculture was developed after 1930.

The acreage in occupied farms in Canada has not changed much in the last 40 years. Of the 169.7 million acres in occupied land (Table 1), 61.5 million are classed as unimproved and consist of 11.5 million acres of woodland and 50 million acres of range land.<sup>2</sup> Additional forage-producing lands include 12.4 million acres in tame hay, 10.2 in improved pasture, and 2.7 in fodder crops, including oats and corn.

These forage resources support 14 million beef and dairy cattle, 541,300 sheep and 340,000 horses (December 1, 1974).<sup>3</sup> The discussion of pasture potential will be confined to the national beef herd.<sup>4</sup> Pasture acreage required by sheep and horses is small and the dairy herd, numbering 2.1 million head, depends mainly on croplands. The dairy herd is expected to continue to decline at a rate of about 3 percent per year.

Estimates of Canada's pasture potential tend to be optimistic, even unrealistic. This paper outlines the authors' idea that the potential is limited to the

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<sup>1</sup> Feed Grains, Forage, and Food Supplies. Food Prices Review Board, June 1975.

<sup>2</sup> Statistics Canada, 1971 Census of Canada. Cat. No. 96-701, Vol. 4, Part I, 1973.

<sup>3</sup> Statistics Canada, Livestock and Animal Products Statistics. Cat. No. 23-203, Annual, 1974.

<sup>4</sup> It is recognized that the feedlot portion of the beef herd depends on croplands.

**TABLE 1. LAND ACREAGES (1971) AND CATTLE NUMBERS (1974, DECEMBER VALUES) IN VARIOUS REGIONS**

| Region                       | Acres        | Cattle numbers |
|------------------------------|--------------|----------------|
|                              | — thousand — |                |
| Atlantic                     |              | 337            |
| Farmland                     | 3,505        |                |
| Pasture                      | 474          |                |
| Improved pasture             | 344          |                |
| Tame hay                     | 451          |                |
| Oats and fodder corn         | 32           |                |
| Southern Quebec              |              | 1,812          |
| Farmland                     | 10,801       |                |
| Pasture                      | 1,252        |                |
| Improved pasture             | 1,712        |                |
| Tame hay                     | 2,698        |                |
| Oats and fodder corn         | 397          |                |
| Southern Ontario             |              | 3,311          |
| Farmland                     | 15,963       |                |
| Pasture                      | 2,797        |                |
| Improved pasture             | 2,336        |                |
| Tame hay                     | 2,707        |                |
| Oats and fodder corn         | 688          |                |
| Prairie Region               |              | 7,960          |
| Farmland                     | 133,571      |                |
| Pasture                      | 42,255       |                |
| Improved pasture             | 5,433        |                |
| Tame hay                     | 5,991        |                |
| Oats and fodder corn         | 1,459        |                |
| Interior of British Columbia |              | 599            |
| Farmland                     | 5,823        |                |
| Pasture                      | 3,224        |                |
| Improved pasture             | 398          |                |
| Tame hay                     | 513          |                |
| Oats and fodder corn         | 77           |                |
| Total — Canada               |              | 14,019         |
| Farmland                     | 169,668      |                |
| Pasture                      | 50,006       |                |
| Improved pasture             | 10,225       |                |
| Tame hay                     | 12,360       |                |
| Oats and fodder corn         | 2,654        |                |

conversion to improved pasture of about 22 million acres of range and marginal cropland in the Prairie region.

## GEOGRAPHICAL REGIONS

Canada is divided into seven geographical regions, (Figure 1): the Atlantic region, southern Quebec, southern Ontario, the Arctic Tundra, the interior of British Columbia, the Prairie region, and the Boreal Forest complex. These regions will be discussed briefly,

except for the Boreal Forest complex, where much of the potential pasture lands supposedly lie.

### The Atlantic Region

Agriculture in the Atlantic provinces is based on a few cool-season crops and a limited amount of arable land. Acreage of occupied land reached a peak about 1891 when 11.6 million acres were in farmland but, soon after, pastures and hayfields were allowed to revert to forest. The trend continues and now only about 3.5 million acres (Table 1) are in occupied land.

The raising of domestic livestock seems to have been of decreasing importance in the Atlantic provinces since the American Civil War. Sheep numbers in Nova Scotia, for example, have declined steadily since 1872. Cattle numbered 620,000 head 50 years ago, compared with only 337,000 head today.

Agricultural scientists have solved such problems as trace element deficiency,<sup>5</sup> growing forage crops on bogs and organic soils, increasing the productivity of pasture and hay land, and establishing grazing systems for cattle and sheep. In general, pasture research appears to be ahead of its large-scale utilization.

### Southern Quebec

Agriculture in southern Quebec is primarily dairy oriented; about half of Quebec's 1.8 million cattle are dairy cattle. Provincial policies, in an effort to diversify and expand agriculture, are designed to produce beef cattle and to feed dairy calves to heavier weights before slaughter.

Occupied land reached a peak about the turn of the century when 14.4 million acres were in farmland, compared with 10.8 million acres today (Table 1). Quebec's cattle population has remained at 1.8 million for the past 50 years.

### Southern Ontario

Like the rest of eastern Canada, Ontario's acreage in occupied land reached a peak about the year 1900 with 21.3 million acres in farmland, compared with 16 million acres today (Table 1). Unlike the rest of eastern Canada, cattle population has increased slightly from 2.8 million 50 years ago to 3.3 million.

<sup>5</sup> Trace elements are the so-called "minor" elements or nutrients required in small amounts by animals and which may be deficient in certain soils (requiring fertilization) and in livestock feeds (requiring supplementation). Examples are zinc, copper, molybdenum, manganese, and iron.



Figure 1

The most striking change in the cropping pattern in recent years has been a rapid increase in corn production, to .7 million acres of fodder corn and 1.2 million acres of grain corn in 1973.

Total pasture acreage includes 2.3 million acres of improved pasture and 2.8 million of unimproved pasture. Pastures were improved on a variety of soil types and have shown a profit over costs of improvement. Tillage, reseeding, fertilization, and weed control have become standard practices.

The 2.8 million unimproved acres have not been exploited, largely because of a lack of profit over improvement costs. Soils are shallow, the land is hilly, drainage is poor, drought or flooding occurs; and hence, improvement efforts have been concentrated on more responsive lands.

### The Arctic Tundra

The tundra, treeless and frozen for much of the year, is perhaps the most distinctive and least known of the

Canadian regions. Wild animals, including the muskox, graze in scattered areas. Today the largest herds of muskox—about 8,500 head—are on the northern islands and only scattered groups are on the mainland. The main interest in muskox today arises from the prospects of domestication and their potential value for meat or wool.

Barren ground caribou are found throughout the Arctic. Herds numbered about 2.5 million in 1900 but by the fifties, excessive slaughter and destruction of winter range by fire reduced numbers to about .2 million. Populations are now increasing gradually.

A few small herds of reindeer—about 6,000 head—are located on 25,000 square miles of range in the Mackenzie River lowlands. They were introduced to make the Eskimo self-sufficient in meat. The experiment seems to have failed as the people have not adjusted to the herdsman's life.

Tundra ranges will probably not be used for any purpose other than grazing by relatively small numbers of wild or semi-wild herbivores.

## The Prairie Region

About half of the prairies' eight million cattle are raised in Alberta (Table 1). Fifty years ago, of the 3.7 million cattle in the Prairie region, about 1.5 million were in Alberta. Forages used to support these animals include 42.3 million acres of native range land, six million acres of hay land, and about 5.4 million acres of improved pasture (Table 1). In Alberta, and probably in the other Prairie Provinces, about 12 percent of the grazing and a large part of the winter feed is obtained from stubble fields and crop residue.

Conversion of native range land to seeded grass-legume mixtures results in a three- to five-fold increase in carry capacity<sup>6</sup>. The trend to conversion is now underway but estimating the acreages involved is difficult. In 1971, 334,000 acres were broken (172,000 acres in Alberta, 103,000 in Saskatchewan, and 59,000 in Manitoba) but location within province and disposition are not known.

## The Interior of British Columbia

British Columbia has about 599,000 head of cattle (Table 1), about 514,000 of which are beef. Fifty years ago, there were 287,000 cattle in the province, 104,000 of them beef. Grazing must fit into a pattern of multiple land use that includes timber production, wildlife, watershed maintenance, and recreational development. Forest fire protection is fairly efficient and is resulting in a considerable invasion of grass range land by trees. Much of the invading tree growth is of little potential value as lumber; however, the range land is being reduced.

## The Boreal Forest Complex

The Boreal Forest complex is not attractive to agriculture. Winters are long, soils are shallow or absent, and often organic, but have scattered pockets of mineral soils. There are insect problems, including mosquitoes and black flies. Agriculture has penetrated into only the clay soils of the central regions of Ontario and Quebec, and in the Peace River region of Alberta and British Columbia.

Agriculture in the Clay Belt of Ontario and Quebec is based on a subsistence type of mixed farming, with emphasis on dairy cattle where markets exist.

Provincial government policies favor a shift to beef production. The Clay Belt is estimated to cover 15.6 million acres<sup>7</sup>. It was settled between 1900 and 1931, when two million acres were occupied as farmland. Only .6 million acres are farmed today. Settlement of the region, encouraged by government, was ill-advised and costly. Poorly drained clay soils, a short growing season, combined with unexpected, severe frosts and scarcity of nearby markets led to bankruptcies and abandonment of farms.

The forest has been settled along the southern edge adjoining the prairie parkland of western Canada. According to S.E. Beacom<sup>8</sup>, agriculture could expand into the inter-lake country and Clay Belt of Central Manitoba and into the Boreal Forest in Saskatchewan north of the 54th parallel of latitude. In Manitoba, there are about 1.4 million potentially arable acres in the Wabowden Clay Belt and about 100,000 acres elsewhere. In Saskatchewan, there are about 1.6 million acres of potentially fair-to-poor arable lands and another 1.4 million acres that might be useful.

The Peace River district of northwestern Alberta and northeastern British Columbia may be considered a pocket of arable soil within the Boreal Forest complex. Agriculture in the Peace River district consists mostly of grain, oilseeds, and forage seed production. The Peace River district and parts of the Northwest Territories and the Yukon are estimated to have about 19.1 million potentially arable acres and another 13 million acres of non-arable land that might be useful for livestock grazing<sup>9</sup>. Alberta's Peace River country has only about 156,000 head of cattle.

Some possibilities for meat production in parts of the Boreal Forest complex include game ranching on a commercial scale, raising buffalo or buffalo-cattle hybrids, horses, or even the Tibetan yak. Many ecological and social problems would have to be solved before these possibilities could be realized. In recent years, several applications for livestock leases have been made in the Great Slave Lake, Fort Providence, Fort Smith, and Fort Resolution areas. Because of the many problems that may be encountered, a moratorium has been placed on permanent leases in the Northwest Territories.

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<sup>7</sup>Pugh, D.E., Ontario's Great Clay Belt Hoax, Canadian Geographical Journal, Volume 90, 1975.

<sup>8</sup>Beacom, S.E., Northern Saskatchewan and Manitoba, *Agrologist* 3: pp 13-17, 1974.

<sup>9</sup>Stacey, E.C., Peace Country Heritage, Western Producers Book Series, Saskatoon, Saskatchewan, 1974.

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<sup>6</sup>Wiens, J.K., Lodge, R.W., and Johnston, A., Seeding Prairie Rangeland: A Management and Economic Guide, Agriculture Canada, Publication 69/13, 1969.

## DISCUSSION

Watkin *et al.*<sup>10</sup> studied marginal land development in Canada and determined acreages of lands classified under the Canada Land Inventory (CLI). (Estimates of marginal lands from census reports were about 65 million acres. This total consists of range land in the west and woodland in the east.) They suggested that, on the basis of CLI Capability Classes 4, 5, and 6, another 42 million acres could be classed as marginal but suited to pasture, for a total of 107 million acres. The investigators suggested that much of this land could be converted to highly productive pastures by fertilization and seeding.

The acreage of potentially useful pasture lands can be estimated in other ways. If the present occupied acreage in eastern Canada is subtracted from lands occupied by farms about the turn of the century, it is found that 17.2 million acres in the Atlantic Provinces, Quebec, and Ontario were once occupied but are now abandoned. These lands should be classed as marginal but suited to pasture. For example, in the Clay Belt of north-central Ontario and Quebec, nearly two million acres were once occupied but only .6 million acres are farmed today, resulting in about 1.4 million acres of marginal land. (The acreage of the Clay Belt is 15.6 million acres. Six hundred thousand are farmed, and, therefore, there is a potential of 15 million acres.)

According to S.E. Beacom<sup>11</sup>, there are about 1.5 million acres of potentially fair-to-poor arable soils in north-central Manitoba and about three million acres in Saskatchewan. There are 19.1 million potentially arable acres in the Peace River region and the adjoining parts of the Northwest Territories and the Yukon, and a further 13 million acres of non-arable lands that may be suited to grazing by livestock<sup>12</sup>. Acreage in British Columbia has a limited potential, although estimates are not available.

If the various estimates are totalled, a range of 42.2 million to 68.8 million acres is obtained. The larger figure includes the 15 million-acre Clay Belt and the 13 million acres of non-arable land in the Peace River

District that may be suited to grazing. The lower figure is close to Watkin's estimate of 42 million additional acres of marginal lands in Canada, obtained from the CLI<sup>13</sup>.

These lands are located in the Boreal Forest complex where land clearing and capital costs of forested areas probably would be at least \$150 to \$200 per acre. Settlement once occupied 17.2 million acres of the total but, for sound economic reasons, the land was abandoned. Soils of the Clay Belt are poorly drained and the region has been described as a land of bone-freezing temperatures, swarming mosquitos, and dreary, swampy landscape<sup>14</sup>. Soils in the Peace River region are mostly Grey Wooded but include large areas of meadow soils, Brown Wooded soils, and Regosols<sup>15</sup>. Probably the same is true of the potentially arable soils north of the prairie region in Saskatchewan and Manitoba.

The winter feeding period in most of the region is about seven months, which means there is a food reserve of 3 to 3.5 tons per animal. At 50 cents per day, wintering costs would be about \$100 per animal.

Much of the potential pasture region lacks even the most basic transportation system, power facilities, or services that rural people expect. Most of it is far from markets. Livestock producers would face special problems involving predators and insect pests.

High yields of hay and pasture depend on application of fertilizers. That the use of fertilizer should even be considered when it could be used so much more effectively in another region remains a question.

It is not probable that in the foreseeable future many people will be persuaded to undertake pioneering settlement and raising livestock in the forested, marginal regions of Canada. On these marginal soils, with excessive climatic hazards, a high degree of managerial skill would be required. Cost-price relationships would have to change radically before settlement could occur.

A much greater potential exists in the conversion of range land and marginal croplands to improved pasture

<sup>10</sup>Watkin, E.M., Winch, J.E., and Aston, M., Marginal Land Development in Canada, Proceedings of the 45th International Agriculture Congress, Kingston, 1969

<sup>11</sup>Beacom, S.E., Northern Saskatchewan and Manitoba, the Agrologist, Volume 3, 1974.

<sup>12</sup>Stacey, E.C., Peace Country Heritage, the Western Producers Book Series, Saskatoon, 1974.

<sup>13</sup>Watkin, E.M., Winch, J.E., and Aston, M., Marginal Land Development in Canada, Proceedings of the 45th International Agricultural Congress, Kingston, 1969.

<sup>14</sup>Pugh, D.E., Ontario's Great Clay Belt Hoax, Canadian Geographical Journal, Volume 90, 1975.

<sup>15</sup>Stacey, E.C., Peace Country Heritage, Western Producers Book Series, Saskatoon, Saskatchewan, 1974.

in the prairie region. Regardless of the location, research has shown that seeded forage crops will yield from three to five times as much pasture as native range land<sup>16</sup>. D.H. Heinrichs<sup>17</sup> estimated that, for efficient land use in Saskatchewan, 25.5 percent of the 39 million acres in the Brown and Dark Brown Soil zones should be seeded to cultivated forage species. Lands to be seeded included some CLI-Capability Class-4-and-5 lands now farmed on an annual crop basis, and suitable areas of native range land. If the estimate is projected to the 28.5 million acres of Brown and Dark Brown soils in Alberta and,

assuming that an additional 10 percent of the 48 million-acre Black Soils zone should be seeded to forage crops, a total of 22 million acres in the prairie region is obtained that could be seeded to forage species. This acreage would produce from 10.5 million to 12.5 million tons of additional feed, enough to carry about 2.5 million additional cattle. (More pasture would have to come from the croplands which is not probable or from the wider use of fertilizers.)

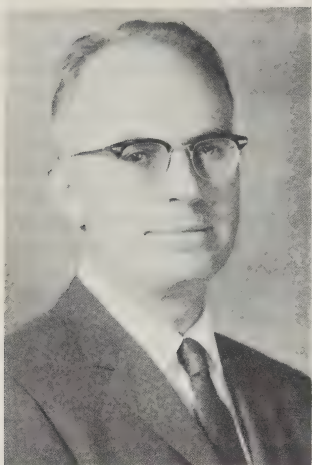
The authors say that this is the only sizable, practical pasture potential in Canada. They are concerned with what they consider to be unrealistically high estimates which could have serious implications in many areas, for example, agriculture, immigration, transportation, wildlife, and forestry, and could affect the regional distribution and types of funding available for pasture improvement under federal-provincial forage programs.

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<sup>16</sup>Wiens, J.K., Lodge, R.W., and Johnston, A., *Seeding Prairie Rangeland: A Management and Economic Guide*, Agriculture Canada, Publication 69/13, 1969.

<sup>17</sup>Heinrichs, D.H., *The Potential of Forage Crops in the Brown and Dark Brown Soil Zones of Saskatchewan*, Agriculture Canada Research Station, Swift Current, Saskatchewan, Mimeo., 1973.

# FARM BUSINESS MANAGEMENT TRAINING PROGRAM



*Both federal and provincial governments as well as the private sector operate programs requiring personnel skilled in various aspects of farm business management. The Canadian Farm Management Committee has initiated a comprehensive performance-oriented program for the training of field staff advising farmers and is now evaluating its potential. The program is a co-operative effort of the provincial departments of agriculture, the federal government, several universities and other institutions.*



*I.L. Corbridge and T.A. Petersen\**

## INTRODUCTION

Both the public and private sectors operate programs that require field staff skilled in farm business management. The provision of on-the-job training to improve the effectiveness of counsellors and keep them up-to-date represents a challenge that can best be approached by means of a co-operative effort.

Many good provincial and university publications and training materials on farm management are available but are often neither known nor used outside the borders of origin. In addition, professionals advising farmers have differing backgrounds, needs, interests and instructional opportunities. Some qualify for educational leave while others are restricted to short courses, seminars, workshops and home study.

Rapid changes in agriculture have made the managerial process increasingly complex and challenging. There is thus an increased need for a wide range of farm management advisory services and a greater level of expertise in the personnel who provide them.

Some farmers request and receive assistance from existing extension programs. Others badly need assistance but are hesitant about seeking it. Some agricultural programs intended to help improve the well-being and performance level of farmer clients are not achieving their full potential because field staff are not always qualified to advise on all farm business management needs and requests. Some federal-provincial staff positions remain unfilled and others are staffed with personnel carrying less than approved ratings. Many counsellors, trained mainly in production skills, are concerned about the increasing number of business management questions being asked of them.

These needs vary widely and are not confined within specific geographic or agency boundaries. They are being answered in varying degrees of effectiveness. No province or agency presumes to have all the answers. Each has some good instructional materials. All are interested in learning about equally good materials on similar or related topics that have been prepared elsewhere.

## THE CHALLENGE

The challenge is to answer these needs, using and sharing existing resources and expertise. Input from those willing to prepare educational materials for areas in which they are well qualified is sought and welcomed.

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This challenge is being met by the Canadian Farm Management Committee (CFMC).

The CFMC represents a cross-section of Canadian agricultural institutions<sup>1</sup>. Among its responsibilities is the identification and assessment of problems arising in the provision of governmental and institutional farm management services. These services include extension, research, teaching, training and information. The committee also has the responsibility for suggesting and analyzing alternative solutions to problems in any of these areas. One of the needs identified was a farm management training program.

The CFMC authorized the formation of a sub-committee to co-ordinate the development of a comprehensive, performance-oriented training program to meet the expressed needs of field staff advising farmers<sup>2</sup>. The group convened in August, 1974 under the supervision of leaders from Holland College in Charlottetown, Prince Edward Island and formulated a chart listing the basic skills required of an effective farm business management counsellor<sup>3</sup>.

## THE CONCEPT

The teaching concept is one of preparing the learner to perform specific measurable accomplishments that are important if he is to be functionally proficient in his field. It is oriented toward performance rather than accumulation of knowledge. Knowledge is necessary, but its proper use is the pay-off.

The basis of the training program is the skill chart, which lists the skills required of an effective farm business management counsellor. The skill chart concept has been the basis of all academic programs at Holland College although it did not originate there. It was also used in developing the instructional units for the Atlantic Farm Management Program and is now being implemented in several training programs in Alberta.

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<sup>1</sup>The CFMC has two representatives from Agriculture Canada and one from each of: the provincial departments of agriculture, the Farm Credit Corporation, Statistics Canada, the Canadian Federation of Agriculture and other agencies or institutions deemed appropriate.

<sup>2</sup>This responsibility was delegated to the Extension Education Sub-Committee with Dr. Phil Wright as chairman. The action group appointed represented all sectors including the provincial departments of agriculture, the Farm Credit Corporation, the Small Farm Development Program, CANFARM and farm organizations.

<sup>3</sup>Initial funding was provided by the Small Farm Development Program, Economics Branch, Agriculture Canada.

The farm management skill chart is an organized listing of the skills the committee identified as necessary to enable a counsellor to provide a broad range of advisory services. The skills are grouped into 11 categories (bands) as shown in Illustration 1. They are the major components of farm management counselling activities and presumably cover most situations a counsellor would encounter in his work with farmers.

For each major skill category, component skills or sub-skills are identified and listed. A course participant would require proficiency in every skill in a category to be completely qualified in that category. Category F is an example and the 11 skills associated with it are shown in Illustration 2. This category is concerned with the skills necessary to "develop and evaluate alternative farm business management plans".

There are a total of 132 skills identified for the 11 categories. Because of space limitations, it is impossible to list them all.

## TRAINING METHOD

Training for each skill is accomplished by means of instructional units called modules. These modules are to be self-sufficient. That is, there will be sufficient coverage of the lesson concepts to make each lesson module self-contained, although each will include cross referencing to other modules that more completely develop some of the related concepts. Text needs, then, are provided within the module teaching materials.

Each module will include explanations, examples and student learning activities that will help the student achieve the performance objectives of each module. Category F, skill number 7 (F.7), which is to "prepare and use partial budgets", can be used as an example. Illustration 3 shows the performance objectives of the module for this skill. Partial budgets are used to project the effects of small changes in the farm business or changes that do not affect the whole farm operation. They are useful to the farm manager in his day-do-day decision-making and in assessing changes in resource use. Only those costs and returns that are expected to change because of a decision need to be included in the calculations to assess changes in expected net benefits.

The instructional materials, carefully prepared by the most knowledgeable personnel available, will represent a broad range of training materials that can be studied according to individual needs and interests. They do not supplant an instructor; they do, however, make him

## **MAJOR CATEGORIES IN FARM BUSINESS MANAGEMENT COUNSELLING**

- A. COMMUNICATE, COUNSEL AND INTERVIEW.**
- B. PLAN, IMPLEMENT AND EVALUATE FARM MANAGEMENT TRAINING AND EXTENSION PROGRAMS.**
- C. ASSIST IN ESTABLISHING, MAINTAINING AND UTILIZING FARM RECORDS.**
- D. OBTAIN AND MANAGE PHYSICAL RESOURCES.**
- E. ADVISE ON FINANCIAL MANAGEMENT.**
- F. DEVELOP AND EVALUATE ALTERNATIVE FARM BUSINESS PLANS.**
- G. ADVISE ON MANAGEMENT IMPLICATIONS OF LAWS AND LEGISLATION AFFECTING FARMERS.**
- H. ADVISE ON MARKETING STRATEGY.**
- I. ADVISE ON ESTATE PLANNING AND BUSINESS ARRANGEMENTS.**
- J. INFORM AND ADVISE ON CONCEPTS OF PERSONNEL MANAGEMENT.**
- K. INFORM AND ADVISE ON BUSINESS MANAGEMENT CONCEPTS AND PROCESSES.**

### **Illustration 1**

## **CATEGORY F SKILLS REQUIRED TO DEVELOP AND EVALUATE ALTERNATIVE FARM BUSINESS MANAGEMENT PLANS**

- 1. Identify and evaluate available resources and management ability.**
- 2. Assist farmer to identify objectives.**
- 3. Analyze effect of farm assistance programs.**
- 4. Advise on planning of purchased inputs.**
- 5. Identify enterprise and/or production alternatives and list corresponding practices.**
- 6. Prepare and use complete budgets.**
- 7. Prepare and use partial budgets.**
- 8. Determine least-cost production methods.**
- 9. Assist in analysis of input-output budget for production alternatives.**
- 10. Evaluate alternative growth strategies.**
- 11. Assist in preparation of complete farm plan.**

### **Illustration 2**

# PERFORMANCE OBJECTIVES FOR SKILL F-7

## (PREPARE AND USE PARTIAL BUDGETS)

- Categorize alternatives to be tested, in terms of whether they deal with  
(a) farming intensity problems (b) resource combination problems  
(c) enterprise combination problems or (d) a mixture of these.
- State a farm business adjustment alternative clearly and concisely so that its profitability can be tested or assessed by use of the Partial Budgeting method.
- Make reliable estimates of *additional costs or reduced receipts* (disadvantages) expected from a proposed alternative or change.
- Make reliable estimates of *additional receipts or reduced costs* (advantages) expected from a proposed alternative or change.
- Discount these estimates to allow for time and uncertainty considerations.
- Assemble all of the relevant information into a Partial Budget form so that the expected *change* in farm profits can be estimated for the proposed alternative being tested.
- Apply the "Principle of Alternative Opportunity Costs" to budgeting alternatives and decision making.
- Help identify non-monetary considerations which may add to or detract from the economic attractiveness of the proposed alternative being tested by the Partial Budget method.
- Explain how the Partial Budget procedure, and economic principles applied to farm business management, are related.

### Illustration 3

more flexible. He can deal with individual student needs as they surface rather than exposing all students to the same teaching explanations even though they may have differing backgrounds, needs, and motivations.

The modules or lesson materials and learning activities are oriented toward performance rather than the accumulation of knowledge. The student is informed at the beginning what he is expected to be able to do after completing the lesson. He then knows what he can expect from the lesson and what is expected of him. This should help in selecting the training modules most appropriate to individual needs and interests. If a seminar or short course includes some skills in which the student is functionally proficient, he can complete the requirements early or help teach peers in team projects.

The modules can be studied individually or in groups. Learning situations can include lectures, team projects, and individual study. Class instruction can be conducted in a combination of ways, even with different topics being studied concurrently by individuals or teams. The instructor is an additional teaching resource rather than the only teaching source. Some learners may be

interested only in the basic lesson material; others may be concerned also with the more advanced concepts provided in an additional section. This freedom of choice enlarges the circle of users.

One can also participate in rating his own performance. This will vary according to needs and institutional requirements. Prior to beginning a module, the student is expected to read the performance objectives of the module to ascertain his need for study. If in doubt, he can test his knowledge through an examination (written, oral or both). After completing a module, he reports his presumed proficiency level to the instructor. If the instructor permits, the student can progress to another training module they both select. However, the instructor may feel additional training is desirable before the student moves to the next module.

Conventional grades can be given if necessary. Illustration 4 shows the performance rating chart.

The rating states the proficiency level achieved for designated skills rather than a single general course grade. However, a course grade can be determined by

## PERFORMANCE RATING CHART

**C - CAN PERFORM THIS SKILL WITHOUT SUPERVISION OR ASSISTANCE AND CAN LEAD OTHERS IN PERFORMING IT.**

**4 B - CAN PERFORM THIS SKILL WITHOUT SUPERVISION OR ASSISTANCE WITH INITIATIVE AND ADAPTABILITY TO SPECIAL PROBLEM SITUATIONS.**

**A - CAN PERFORM THIS SKILL WITHOUT SUPERVISION OR ASSISTANCE WITH PROFICIENCY IN SPEED AND QUALITY.**

|   |  |
|---|--|
| 3 | CAN PERFORM THIS SKILL SATISFACTORILY WITHOUT ASSISTANCE OR SUPERVISION.   |
| 2 | CAN PERFORM THIS SKILL SATISFACTORILY BUT REQUIRES PERIODIC SUPERVISION OR ASSISTANCE.                                   |
| 1 | CAN PERFORM SOME PARTS OF THE SKILL SATISFACTORILY BUT REQUIRES INSTRUCTION AND SUPERVISION TO PERFORM THE ENTIRE SKILL. |
| 0 | HAS SOME KNOWLEDGE AND LIMITED EXPERIENCE, BUT NOT SUFFICIENT FOR PARTICIPATION IN A WORK ENVIRONMENT.                   |

**Illustration 4**

means of a weighted average of the individual skill ratings.

### USES

The program can serve a variety of user needs including:

- Farm managers or farm management counsellors, studying individually where there is sufficient need and interest;
- Short courses and seminars for the above personnel. Instructors can personally present the course materials and involve the students in selected learning experiences, working individually or in teams;
- Supplementary reference-teaching materials for traditional classroom instruction;
- Resource materials for field staff use in preparing their own training sessions for farmers.

### PROGRESS

Provinces, universities, and federal agencies are included in the list of those committed to prepare instructional modules, either now or in the future as their resources permit. Nine modules have been prepared to the point of field testing as a pilot project, with several more in

various stages of development. Interested users are encouraged to gain access to these materials, help ascertain their usefulness and indicate what changes should be made<sup>4</sup>.

### FUTURE

The future of this co-ordinated program depends on the uses made of it. If the instructional materials become as useful as they are potentially capable, the CFMC is ready to seriously consider plans that will enable the service to function effectively. Staff will be needed to co-ordinate and update the materials' development and dissemination. Who, how, where, and when can be answered if there is sufficient evidence of interest and need.

### SUMMARY

The program concepts are sound. It is an excellent example of federal-provincial-university co-operation

<sup>4</sup> Contact Mr. R.E. Benoit, Economics Branch, Agriculture Canada, Ottawa, K1A 0C5, for information on how to obtain and use the modules.

with each contributing in a way that best utilizes their unique capabilities.

The program makes extended use of the good materials from all provinces. It permits some adaptations to local conditions. It broadens the usefulness of those competent to prepare the necessary materials. Instruction on subjects relevant to job performance is

provided. The program is flexible to meet a variety of needs. It is an economical and effective way of fine-tuning field staff so they can more effectively deliver funded programs. It can help in training persons entering private and public services. It is an effective way of using available resources in achieving objectives. In summary, it is practicing good management principles while teaching good management concepts.

# POLICY AND PROGRAM DEVELOPMENTS

## WESTERN GRAIN STABILIZATION ACT

**Effective April 1, 1976**

**Statutes of Canada, 1974-76, Chapter 87.**

This Act, which has been in the making for several years, is designed to stabilize grain income on the prairies by eliminating the sharp declines in income of recent years. It creates a fund that will be used to maintain net flows of cash from grain sales at the level of the average for the previous five years. The prairie producer contributes to the fund 2 percent of gross cash receipts from sales of wheat, barley, oats, rye, flax seed or rapeseed, to a maximum of 2 percent on \$25,000. Therefore, his maximum contribution in one year could be \$500. These contributions are tax deductible as a farming expense. The federal government contributes two dollars for every dollar the producer puts in, and pays all administrative costs.

As the plan comes into effect every producer is automatically in it. Those who don't want to participate have three years in which to opt out. Having once opted out, a producer is still free to re-enter, subject to certain conditions.

When a farmer decides to sell or retire, he may sell his interest in the fund as an asset of his farming operation, or he may retain full interest in the fund for himself. He will then be entitled to a proportionate share of any payment made in the last year in which he contributed levies, or in the two preceding years. After this latter time his interest will expire.

The plan is administered by the Canadian Wheat Board. Its main provisions are outlined in a folder entitled "The Western Grain Stabilization Plan . . . now at work for you."

## CANADA GRAIN ACT

**Amendment effective October 1, 1976**

This legislation established two additional Canada Eastern Grades for white winter wheat: Extra No. 4 CE and Extra No. 5 CE. Wheat eligible for these grades is of the same basic quality as No. 2 CE, except for there being a higher tolerance of sprouted kernels in the new grades.

The amendment also established separate CE grade standards for beans of the Cranberry, Blackeye and Yelloweye classes. Specifications for these grade standards are mainly similar to those for other classes of CE beans, except that there are higher tolerances for split beans in the 1, 2 and 3 grades of the specified classes.

The amendment provides new designations of quality for crops harvested in eastern Canada. It is intended to enable growers to relate quality to price, and thereby increase the returns for their products.

Both schedules (printed in the February 11 issue of the Canada Gazette) specify standards of quality for these grain classes, including weight per bushel, degree of foreign material allowed, degree of soundness, maximum limits of splits, etc.

The October dateline was decided on to conform with a section of the Act which requires that a notice of eight months be given before changes are made in the grades schedule.

## REGIONAL DEVELOPMENT INCENTIVES ACT

**Administered by the Department of Regional Economic Expansion**

**Statutes of Canada, 1974-76, Chapter 84.**

This amendment extended by five years (from Dec. 31, 1976 to Dec. 31, 1981) the date by which facilities must be brought into commercial production to qualify for a development incentive or a loan guarantee under the Act. It also extends by five years the effective period for conditions concerning the use of manpower services. These conditions concern keeping the Department of Manpower and Immigration informed of manpower vacancies and requirements, discussing with the department the applicant's long-term plans for the recruitment and training of employees, and participating in and co-operating with the department concerning programs related to employment counselling, placement and manpower adjustment and mobility and training. These conditions are relative to the designated region in which a development incentive or loan guarantee is to be used.

## **ANIMAL DISEASE AND PROTECTION ACT**

**December 20, 1975.**

**Statutes of Canada, 1974-76, Chapter 86**

**Supersedes the Animal Contagious Diseases Act**

The Health of Animals Branch of Agriculture Canada is responsible for keeping livestock free from disease. This new Act gives the branch increased authority and stricter control over such health matters as livestock transportation, collection and storage of semen in centres for artificial insemination, manufacture and importation of veterinary biologics, maintenance of animal deadyards, marketing and distribution of products from these yards, health measures in zoos and game farms, and the licensing of garbage used to feed swine.

Under the new provisions, compensation made for animals condemned for brucellosis, tuberculosis or Johne's disease will be as close as possible to the animal's net value, up to the approximate maximum rates, less the salvage value of the carcass. This will give more equitable compensation to the owner whose animal has little salvage value. The Act also provides compensation for animal products, by-products, feed, fertilizer or other things destroyed because of an outbreak of foreign diseases.

## **AGRICULTURAL PRODUCTS CO-OPERATIVE MARKETING ACT**

**Amendment effective December 20, 1975**

**Statutes of Canada, 1974-76, Chapter 85**

This amendment authorizes the government to fix an initial payment to producers for products to which the Act applies, based on estimated wholesale market prices and marketing costs in the production year for which the payment will be made.

The amendment changes the basis on which the initial price is calculated so that the price can be set at a more realistic level, taking into account current market conditions and price expectations.

The Act applies to any agricultural products except those covered by the Canadian Wheat Board Act in designated areas.

**Separate Pooling for Malting Barley (Bill C-88)**

On March 8 the House of Commons gave first reading to a bill to amend the Canadian Wheat Board Act in order

to establish separate pools for barley and other selected grains. The Bill also provides a permanent basis for election of prairie grain producers to the advisory committee of the Canadian Wheat Board. Otto Lang, Minister Responsible for the Canadian Wheat Board, explained the amendment this way: "A separate pool for barley . . . for malting purposes will ensure that only those costs incurred in marketing malting barley are charged to that pool. With a separate pool, those producers who deliver selected grains such as malting barley will receive the full benefit of any premiums obtained by the Board for it." Mr. Lang pointed out that under the amendment it will be possible to treat deliveries of malting barley in the current crop year as a separate pool account, because it is intended to be retroactive to the beginning of the crop year.

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## **World Food Program**

At the World Food Program Pledging Conference at the UN in February, the Minister of Agriculture, Mr. Whelan, committed \$100 million in Canadian food aid for 1977-78. This was more than double the \$40 million pledged for 1975-76. The contribution will be made in cereal grains, non-grain foods, and cash. Mr. Whelan also announced a supplementary commitment for 1977 of additional cereal grains, to bring the total grain contributions to 400,000 tonnes. Canada is one of 45 countries which pledged contributions to the food program. In addition to grain this country regularly provides skim milk powder, egg powder, beans, peas and other high-protein foods.

## **Grain for China**

On February 27 the minister responsible for the Canadian Wheat Board, Mr. Lang, announced the sale of 950,000 long tons (35.4 million bushels) of wheat to China. Shipments will be sent between April and December of 1976. Most of the wheat will be No. 3 Canada Western Red Spring.

## **Wheat Board Initial Payments and Quotas**

On March 1 the minister responsible for the Canadian Wheat Board, Mr. Lang, announced the government's recommendations for grain production in the coming crop season, along with guaranteed initial payments and minimum quotas for the crop year beginning August 1. These annual announcements are intended to give western grain producers details about the level of initial payments and seed acreages for major prairie crops. Mr. Lang recommended increased production of wheat, except for durum, and for barley, oats and rye. He

proposed 25 million acres of wheat, a 26-percent increase over last year, and 2 million acres of durum, down 47 percent. Desirable barley acreage was set at 12 million acres (up 8 percent), oat acreage at 6 million acres (up 13 percent), and rye acreage at 600,000 (up 17 percent). However, decreases of 47, 24 and 7 percent were recommended for durum, rapeseed and flax. For summerfallow acreage on the prairies, a decrease of 13.5 percent was recommended, almost 4 million acres less than last year's total.

For initial payments, effective August 1, on deliveries to the Canadian Wheat Board in the 1976-77 crop year, the government would guarantee (basis in store Thunder Bay or Vancouver) the following: No. 1 Canadian Western (CW) Red Spring Wheat, \$3.00 a bushel; No. 2 CW Six-Row barley, \$1.80; No. 2 CW Six-Row selected and accepted barley, \$2.30; No. 2 CW oats, \$1.20.

Guaranteed minimum deliveries were set at 500 million bushels for wheat, 50 million for durum, 200 million for barley and 20 million for oats.

Full details of these announcements, including production and marketing information, were sent to all prairie producers in a booklet, "Outline of Initial Payments, Guaranteed Quotas, Recommended Acreages," issued by the Canadian Wheat Board in Winnipeg.

### **Wheat Board Contracting Program**

On March 2 the Canadian Wheat Board announced its contracting program for this year's production of new grain varieties in Western Canada. The program provides for production of more than a million acres of new grain. The selected varieties include two utility wheats, two durums and two barleys. Because more experimentation is needed before commercial acceptability can be assured, the grain grown under contract this year will be used for continued testing and for sales to the Wheat Board.

The varieties are Glenlea and Purple Wheat, both utility types, the latter intended for feeding; Wakooma and Macoun durum; and Beacon and Klages barley. The temporary licence for Beacon has been extended to July 31, 1977. Klages has not yet been released for general production in Canada.

The purpose of the program is to test market reaction to new varieties under development and to encourage production of varieties with good sales potential. The

board sets the minimum and maximum acreage of each variety that a producer may sow. For example, 30 to 400 acres of Glenlea may be sown, and durum varieties are to be sown in multiples of 50 acres, up to 300.

### **Two Grain Varieties Licensed**

Agriculture Canada has licensed two new cereal varieties — Chester, a hard red spring wheat developed for growing in southern Alberta and southeastern Saskatchewan, and Terra, a naked spring oat adapted for western Canada but susceptible to rust if sown late in Manitoba. Neither variety is available to commercial grain growers this year.

### **Cheese Import Quotas**

In March the yearly import quotas for cheese were set at 50 million pounds, the same amount as last year. Imports of cheddar will not exceed last year's maximum of 1 million pounds. The basis for issuing these quotas was changed from the calendar year to the dairy year, April 1 to March 31. The Minister of Agriculture, Mr. Whelan, said that these imports, supplementing domestic cheese production, were expected to meet the needs of Canadian consumers.

### **Packaged Food**

On March 1 certain regulations under the Consumer Packaging and Labelling Act came into effect. The Act is administered by the Department of Consumer and Corporate Affairs.

Milk, bread and other packaged foods with a shelf-life of less than 90 days are now obliged to carry on the label the words "Best before . . ." followed by the date after which the food will not be of best quality. Exceptions are fresh fruit and vegetables, meat, fish and poultry packed in the store. The food may be sold after the so-called "durable life date" but it is expected that customers will learn to know when food is past its best quality.

The regulations also require that ingredients of a product be listed on the label in both languages, in order according to their proportion in the product. In place of the durable life date on in-store meat, fish and poultry, stores must stamp on the date of packaging. Stores are requested to inform customers about how long meats can remain good after packaging.

## **CANFARM**

In February, CANFARM's computer services were improved and extended to give farmers access to better bookkeeping and planning services in 1976. Under the new farm record system, farmers send in monthly information on their operations and the CANFARM computer returns whatever reports they want — on income, expenses, cash flow, credit, taxes, etc.

CANFARM, based in Guelph, Ontario, is operated by the federal government, the provincial governments and various agricultural schools and colleges. It is a computerized farm management service available to farmers at a low cost. Last year it was used by more than 10,000 farmers to organize and store their records. Its services are also used to assess proposed changes in a farm operation, to calculate interest on loans, to plan rations and feeds, and to estimate replacement time for machines.

## **Cow-beef Programs**

In February, the deadline for claims under the cow-slaughter and beef stabilization programs was extended to April 30. The cow-slaughter program paid producers \$5.08 a hundredweight (liveweight) on cows sold between November 1974 and April 1975. The beef stabilization program for the year August 1974 to August 1975 offered 48 cents a hundredweight (liveweight) for A, B and C quality cattle sold for slaughter in that time.

## **Sire Appraisal Program**

In February, Agriculture Canada announced a new dairy sire appraisal program, administered by the department's Livestock Division. The system, which is available to dairymen across Canada, makes a more valid comparison between the cow being assessed and other cows in the same herd. Sire ratings from the Direct Sire comparison are based on production records of two-year-olds in herds enrolled in Record of Performance and Supervized Dairy Herd Improvement. The Direct Sire Comparison evaluates sires for production traits by considering: (1) age and month of calving, (2) sire genetic effects and genetic relationships among all bulls, (3) herd, year and season differences where each year is divided into two seasons, (4) rates of genetic improvement in both young sires that enter service each year and two-year-old heifers that freshen each year, and (5) sires of the herdmates to which a bull's daughters are compared. The calculations are done through the use of computers.

## **Sweet Cherries**

In February, the government stabilized producers' returns from last year's sweet cherry crop to offset depressed prices caused by an oversupply. Under the Agricultural Stabilization Act, the stabilization program paid growers  $3\frac{1}{2}$  cents a pound, the difference between the support price of 24 cents a pound and the average returns to producers in 1975. The support price is based on 90 percent of the average market price for the previous five years, adjusted upwards to reflect increased production costs in 1975 over the average of the previous five years.

## PUBLICATIONS

### ECONOMICS BRANCH, AGRICULTURE CANADA

*Available from the Publications Manager, Room 303, Sir John Carling Building, Ottawa, K1A 0C5.*

**A Supply Response Model of Canadian Rapeseed and Soybeans.** I.H. Uhm. Ottawa, December 1975. 57 pp. Pub. No. 75/15.

### AGRICULTURE CANADA

*Available from the Information Division, Agriculture Canada, Sir John Carling Building, Ottawa, K1A 0C7, unless otherwise indicated.*

**5 Days to Metric.** Programmed course for learning metric for the farmer. Sequel to the Metric System for Farmers, and Metric and the Grain Trade. Bilingual folder.

**Agricultural Productivity of the Soils of Ontario and Quebec.** J.L. Nowland. Ottawa, 1975. 19 pp. Tables, figures, maps. Cat. No. A54-3/13.

**Shelterbelts for the Peace River Region.** R.E. Harris. Ottawa 1975. 23 pp. Figs. Pub. No. 1384.

**Pork Cuts.** Colored chart 8 x 11 in. showing retail and wholesale cuts of pork. Bilingual. 50¢ a copy. Cat. No. A72-3/1

**Swine Vesicular Disease.** 1976. Illustrated folder. Pub. No. 1550.

**Federal Farm Programs.** A.R. Jones (comp.) 1976. Summary of all programs. Same series as the Provincial Farm Programs.

**Agriculture Abroad.** Bi-monthly digest of policies and programs in various countries. February 1976. Order from International Liaison Service, Agriculture Canada, Room 369, Sir John Carling Building, Ottawa, K1A 0C5. Cat. No. A77-3/30-6.

**Canadian Agricultural Insect Pest Review.** J.S. Kelleher. Research Branch, Ottawa. Vol. 51, 1973. Cat. No. A47-2/51.

**Selected Dairy By-products: Production and Inventory of Instant Dry Skim Milk Powder.** January 1976.

Bilingual service bulletin. \$1.40 a year. Cat. No. CS 32-024.

**Stocks of Fruit and Vegetables.** February 1, 1976. Bilingual. 30¢ a copy, \$3 a year. Cat. No. CS 32-010.

**Selected Dairy By-products: Production and Inventory of Process Cheese.** December 1975. Bilingual. \$1.40 a year. Cat. No. CS32-024.

**Farm Implement and Equipment Sales.** January to November 1975. Bilingual. 15¢ a copy, \$1.50 a year. Cat. No. CS63-009.

**Tobacco and Tobacco Products: Production and Disposition of Tobacco Products.** December 1975. Bilingual. \$1.40 a year. Cat. No. CS 32-022.

### PARLIAMENTARY PUBLICATIONS

*Available from Printing and Publishing, Publications Centre, Mail Order Services, Supply and Services Canada, Ottawa, K1A 0S9.*

**Bills of the House of Commons, 1st session, 30th parliament, 1974-1975.** Bilingual. Subscription \$10. Cat. No. XB 301.

**Complete Proceedings on Bill C-41, the Western Grain Stabilization Act.** Includes report of House Standing Committee on Agriculture. 20¢ a copy. Cat. No. YC25-301/1-29.

### OTHER PUBLICATIONS

**Federal Farm Credit Statistics, 1975.** 68 pp. Bilingual. Tables, charts.

*Write to the Farm Credit Corporation, P.O. Box 6309, Station J, Ottawa K2A 3W9. Cat. No. A96-2/1975.*

**Advertising Expenditures and Food Prices.** Food Prices Review Board, Ottawa, February 1976. English text, 18 pp. Bilingual. Tables. Cat. No. RG27/1976.

*Write to Consumer and Corporate Affairs, 22nd floor, Zone 6, Place du Portage, Ottawa-Hull, K1A 0C9.*

**Dairy Foods II: Policy.** Food Prices Review Board, Ottawa, February 1976. English text, 26 pp. Bilingual. Cat. No. RG27-28/1976. See address above.

**Telling It Like It Is: Final Report.** Food Prices Review Board, Ottawa, February 1976. English text, 114 pages. Bilingual. See address above.

**Food Prices Review Board Reference Papers:**

1. Role and importance of future markets to Canadian agriculture
2. Tax provisions affecting farmers
3. Land-use policy
4. Edible oils industry in Canada
5. World food: prospects and perspectives
6. Supermarket market power
7. Family food expenditure in Canada
8. Food policy aspects of nutrition and health
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**Greenhouse Industry 1973–1974.** Ottawa, 1975. 33 pp. Tables. Bilingual. 70¢ a copy. Cat. No. CS22–202/1974.

**Stocks of Frozen Meat Products.** December 1975. Bilingual. 30¢ a copy, \$3.00 a year. Cat. No. CS32–012.

**Coarse Grains Review.** November 1975. Bilingual. \$1.05 a copy, \$4.20 a year. Cat. No. CS22–001.

**Field Crop Reporting Series, 1975.** No. 20 – November estimate of production of principal field crops, Canada. Released Jan. 23, 1976. Bilingual. \$5.60 for series of 20 reports. Cat. No. CS22–002.

**Oilseeds Review.** December 1975. Bilingual. \$1.05 a copy, \$4.20 a year. Cat. No. CS22–006.

**Agriculture: Cross-Classified Socio-Economic Characteristics of Farm Operators' Households, Canada and Provinces.** Ottawa, 1976. Tables. \$1.40 a copy. Cat. No. CS96–716.

**Tobacco and Tobacco Products: Tobacco Stocks.** February 1976. Bilingual service bulletin. \$1.40 a year. Cat. No. CS32–022.

**Grain Milling Statistics.** November 1975. Bilingual. 30¢ a copy, \$3 a year. Cat. No. CS32–003.

**Farm Cash Receipts.** December 1975. Bilingual. 30¢ a copy, \$3 a year. Cat. No. CS21–001.

**Fruit and Vegetable Preservation: Pack of Frozen Fruits and Vegetables as Reported to End of 1975.** Bilingual service bulletin. \$1.40 a year. Cat. No. CS32–023.

## DEFINITIONS

*The following definitions are provided to help readers better understand the articles in this issue:*

### Article No. 1

**Real Total Expenditure** — or expenditure in constant dollars, is calculated by dividing the total in current dollars by its price deflator.

**Engel Curve** — is a function describing how the consumption of a particular commodity varies with the level of family income.

### Article No. 3

**Improved Pasture** — All land that has been cultivated, seeded to pasture and used for grazing (census definition). It does not include natural prairie or hay land that was pastured after the crop was removed.

**Marginal land** — land with restricted agricultural capability because of adverse climate, shallow or poor soil, poor drainage, steep topography, stones, bush, etc. It may have capability for pasture production and may

respond to management practices such as re-seeding, fertilizer and drainage if machinery use is feasible. Such land may correspond to classes 5 and 6 of the Canada Land Inventory, Soil Capability for Agriculture.

### Article No. 4

**Partial Budgets** — budgets used to project the net effects of small changes in the farm business or changes that do not affect the whole farm operation. Only those costs and returns that are expected to change because of a decision need to be included in the calculations to assess changes in expected net benefits.

**Complete Budgets** — Budgets used to project the total and net effect of a planned operation. They may come into play in projecting total farm and net income for a beginning farmer or in calculating the effects of an over-all change in operation of an established farmer. All costs and returns for the farm operation are considered.

---

## IN REPLY

Since the last issue of Canadian Farm Economics more readers have sent us comments on the October and December editions, particularly on M.L. Meredith's October article on the Prairie Community System. Grahame Allen, director of the Peace River Regional Planning Commission, sent the author a copy of his own article on a similar subject and asked for permission to print a shortened version of Ms. Meredith's article in a newsletter. This the author agreed to.

Win Stokes, a rural development officer for the Small Farm Development Program in Red Deer, Alberta, found the article "a useful conceptualization of detached bits of information, presented to an audience not usually exposed to this type of thinking." He added, "It is not particularly new or innovative to me, as I have also done some study in this field, but I am pleased you bothered to print it and open up this rural social perspective." Mr. Stokes expressed two concerns: that the article did not "get into the really thorny area of creating the sort of community consortium" alluded to in the conclusion;

and that "in today's interdependent system the role of the larger urban centre has been underrated."

R.N. Plank, assistant branch manager of the Farm Credit Corporation in Kelowna, British Columbia, questioned the authors of the October article on The Economics of Waste Heat Utilization. The section on the costs of building and operating a new greenhouse facility (p.15), he wrote, "may only show that 100 percent of capital cannot be borrowed at 9 percent. How many farmers can, and do, borrow 100 percent of capital?" The authors' reply in part is the following: "We interpret from your comment ... that you are implying that no institution would lend 100 percent of the capital required. We quite agree with your point. However, regardless of the portion of capital which is borrowed, the grower will be paying interest directly on that money which has been invested (we call this opportunity cost). For the sake of convenience, we assumed 100 percent capital as borrowed, since the cost of interest on investment would be the same, taking opportunity cost

into consideration, regardless of the portion directly borrowed."

Gérard Bélair, an economist with Trans-Kébec food markets, Montreal, commenting on the Farm Food Marketing Costs article in the October issue, hoped that more studies of this kind would be available on more food products. A study by provinces, he said, would complete the picture.

Mr. Bélair found the December issue (1975 Situation and 1976 Outlook) "an indispensable tool for studying the agricultural situation in Quebec" and he urged that the study be extended to cover enterprises by type. S.A. Storm, a farmer near Alhambra, Alberta, found this issue useful "as it went into details on matters which concern me as a farmer." Another farmer, John Derworiz of Yorkton, Saskatchewan, found all the December articles useful.

C.B. Kelly, an extension plant pathologist at the University of Guelph, Ontario, wrote concerning the study of agricultural chemicals, "It is good to see someone look at pesticides — any or all of them." Professor R.S. Butler at the Western College of Veterinary Medicine, University of Saskatchewan in Saskatoon, found the article on National and Regional Productivity of Canadian Agriculture "most useful."

Walt Pierson, a district agriculturist in Warner, Alberta, found the study of farm finance "well organized and documented." He was disappointed by the lack of explanation for some of the credit trends. "Also the predicted outlook was a bit discouraging. I think there must be other factors to consider, such as communication, publicity and public awareness of the agricultural needs."

These letters have been passed on to the authors, who have been asked to reply if they see fit. The editors thank all who have written. Your letters are most helpful.

---

## **CORRECTION**

### **Volume 10, Number 6, December 1975**

Page 56, Table 1. Under the heading Maritimes, 1973, figures 278 and 2.6 should read 321 and 3.2, respectively. Under the heading Canada, 1973, the figure 288 should read 262.



John McConnell, Managing Editor, Canadian Farm Economics,  
Economics Branch,  
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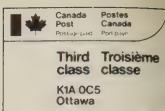


## CONVERSION FACTORS FOR METRIC SYSTEM

| Imperial units         | Approximate<br>conversion factor   | Results in:                          |
|------------------------|------------------------------------|--------------------------------------|
| <b>LINEAR</b>          |                                    |                                      |
| inch                   | x 25                               | millimetre (mm)                      |
| foot                   | x 30                               | centimetre (cm)                      |
| yard                   | x 0.9                              | metre (m)                            |
| mile                   | x 1.6                              | kilometre (km)                       |
| <b>AREA</b>            |                                    |                                      |
| square inch            | x 6.5                              | square centimetre (cm <sup>2</sup> ) |
| square foot            | x 0.09                             | square metre (m <sup>2</sup> )       |
| acre                   | x 0.40                             | hectare (ha)                         |
| <b>VOLUME</b>          |                                    |                                      |
| cubic inch             | x 16                               | cubic centimetre (cm <sup>3</sup> )  |
| cubic foot             | x 28                               | cubic decimetre (dm <sup>3</sup> )   |
| cubic yard             | x 0.8                              | cubic metre (m <sup>3</sup> )        |
| fluid ounce            | x 28                               | millilitre (ml)                      |
| pint                   | x 0.57                             | litre (ℓ)                            |
| quart                  | x 1.1                              | litre (ℓ)                            |
| gallon                 | x 4.5                              | litre (ℓ)                            |
| <b>WEIGHT</b>          |                                    |                                      |
| ounce                  | x 28                               | gram (g)                             |
| pound                  | x 0.45                             | kilogram (kg)                        |
| short ton (2000 lb)    | x 0.9                              | tonne (t)                            |
| <b>TEMPERATURE</b>     |                                    |                                      |
| degrees Fahrenheit     | (°F-32) x 0.56<br>or (°F-32) x 5/9 | degrees Celsius (°C)                 |
| <b>PRESSURE</b>        |                                    |                                      |
| pounds per square inch | x 6.9                              | kilopascal (kPa)                     |
| <b>POWER</b>           |                                    |                                      |
| horsepower             | x 746<br>x 0.75                    | watt (W)<br>kilowatt (kW)            |
| <b>SPEED</b>           |                                    |                                      |
| feet per second        | x 0.30                             | metres per second (m/s)              |
| miles per hour         | x 1.6                              | kilometres per hour (km/h)           |
| <b>AGRICULTURE</b>     |                                    |                                      |
| gallons per acre       | x 11.23                            | litres per hectare (ℓ/ha)            |
| quarts per acre        | x 2.8                              | litres per hectare (ℓ/ha)            |
| pints per acre         | x 1.4                              | litres per hectare (ℓ/ha)            |
| fluid ounces per acre  | x 70                               | millilitres per hectare (ml/ha)      |
| tons per acre          | x 2.24                             | tonnes per hectare (t/ha)            |
| pounds per acre        | x 1.12                             | kilograms per hectare (kg/ha)        |
| ounces per acre        | x 70                               | grams per hectare (g/ha)             |
| plants per acre        | x 2.47                             | plants per hectare (plants/ha)       |

CANADA DEPARTMENT OF AGRICULTURE  
OTTAWA, ONT.  
K1A 0C5

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VOLUME 11

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# CANADIAN FARM ECONOMICS

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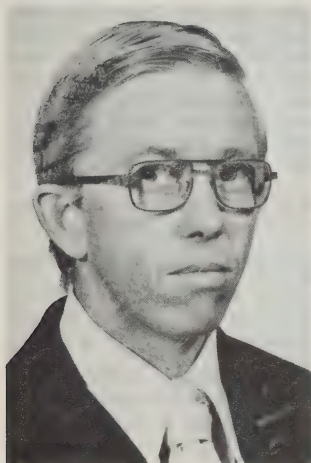
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**Letters from readers:** Letters are encouraged and should be addressed to the author or the Managing Editor. Responses, .comments, suggestions and points of view are important for effective two-way communications. Letters may be used in the following issue of CFE and will be edited prior to publication where necessary.

# A CAPITAL BUDGETING MODEL FOR EVALUATING FARM REAL ESTATE PURCHASES



W.F. Lee\*

*The maximum bid price in purchasing farm real estate is most sensitive to the terms of financing, residual net income per acre, and inflation in land prices. This was shown when 11 economic variables that affect the price a buyer can afford to pay for farmland were incorporated into a discounted cash flow model.*

## INTRODUCTION

The purchase of a parcel of real estate can be one of the most difficult investment decisions confronting farm operators. Compared with other production inputs, land is purchased infrequently and large amounts of capital are usually required. The importance of the bidding decision involved is increased by the knowledge that if the buyer's offer is not reasonably close to the seller's asking price, another buyer could outbid him. Another comparable parcel may not come up for sale for some time.

It is thus very important for a buyer to determine what his maximum bid price would be. Sharply rising farm real estate values have prompted increasing numbers of farmers and prospective farmers to question how much they can pay for land. Land and buildings have always been the largest category of investment in farming. In 1974, real estate accounted for 72 percent of the total value of farm capital in Canada. On the average, farmland values have increased about 8 percent per year since 1961 (Table 1), and in many urban fringe

areas and in some rural areas price increases have been much greater than the national and provincial averages. Rising land prices make getting started in farming difficult, and those already in farming find that expanding their land holdings has become increasingly expensive. Nevertheless, farmers who already own land generally benefit from the capital gains created by rising land prices. McClatchy and Campbell have estimated that, in 1971, capital gains on land contributed, on average, between 8 and 22 percent of real farm family income, depending on the province [8]. Over time, increases in farmland and values have been similar to increases in the value of farm cash receipts (Table 1). These increases have been approximately double the average yearly increases in the Consumer Price Index during the last 15 years.

## A MODEL FOR EVALUATING LAND PRICES

The traditional formula used by real estate appraisers to estimate land value is  $V = I/r$  where  $V$  is the estimated value,  $I$  is the expected residual net return to land and  $r$  is the capitalization rate [9]. For example, if the net rental income from a parcel of land is expected to be \$50 per acre and the opportunity cost of money is 10 percent per year, then the estimated land value is:

$$V = I/r = \$50 \div 0.10 = \$500 \text{ per acre.}$$

\*Warren Lee is an economist in the Family Farm Services Section, Farm and Rural Development Division, Economics Branch, Agriculture Canada, on leave of absence from the Department of Agricultural Economics and Rural Sociology, The Ohio State University.

TABLE 1. INDEX OF FARM LAND VALUES PER ACRE AND FARM CASH RECEIPTS, 1960-74

| Province                                   | 1960       | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 |
|--|------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
|  | 1961 = 100 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| British Columbia                           | 100        | 100  | 100  | 106  | 109  | 120  | 139  | 146  | 165  | 173  | 181  | 189  | 197  | 230  | 321  |
| Alberta                                    | 98         | 100  | 106  | 115  | 129  | 148  | 165  | 184  | 199  | 195  | 186  | 182  | 184  | 207  | 267  |
| Saskatchewan                               | 97         | 100  | 108  | 127  | 149  | 179  | 206  | 227  | 232  | 206  | 190  | 187  | 187  | 216  | 270  |
| Manitoba                                   | 96         | 100  | 102  | 109  | 122  | 139  | 152  | 169  | 179  | 167  | 155  | 153  | 153  | 176  | 224  |
| Ontario                                    | 93         | 100  | 104  | 106  | 116  | 124  | 138  | 158  | 182  | 213  | 219  | 244  | 255  | 309  | 403  |
| Quebec                                     | 97         | 100  | 107  | 102  | 106  | 113  | 122  | 125  | 135  | 142  | 150  | 144  | 157  | 179  | 206  |
| New Brunswick                              | 94         | 100  | 95   | 94   | 98   | 103  | 114  | 118  | 130  | 139  | 151  | 148  | 159  | 182  | 227  |
| Nova Scotia                                | 95         | 100  | 97   | 97   | 101  | 105  | 115  | 121  | 128  | 137  | 144  | 144  | 150  | 172  | 221  |
| Prince Edward Island                       | 100        | 100  | 105  | 106  | 109  | 112  | 124  | 134  | 145  | 152  | 152  | 149  | 164  | 194  | 251  |
| CANADA                                     | 96         | 100  | 104  | 111  | 123  | 139  | 154  | 172  | 185  | 188  | 178  | 178  | 182  | 213  | 271  |
| Index of total farm cash receipts (Canada) | 96         | 100  | 108  | 110  | 120  | 130  | 146  | 150  | 150  | 143  | 145  | 156  | 186  | 232  | 288  |

Source: Index of land values is based on Statistics Canada data, published in Federal Farm Credit Statistics, 1975, Farm Credit Corporation, Ottawa. Index of cash receipts is calculated from Statistics Canada data.

As Crowley suggests, this formula provides an accurate estimate only if three conditions are met: (1) the investment is expected to produce the same annual net rent over time; (2) the capitalization rate used to discount future net rent remains constant; and (3) an infinite or very long planning period is considered. Crowley shows that these three conditions are rarely met and that the apparent rate of return on farmland, given by  $r = I/V$ , generally underestimates the actual rate of return [4]. The subsequent discussion of the model gives the reasons for this result.

Despite the obvious shortcomings of the traditional income capitalization approach, the price that a prospective buyer can afford to pay for a parcel of land is strongly influenced by his income expectations and his opportunity cost of capital. By expanding the capitalization formula to include more of the variables that affect income expectations, the price that is determined should be more realistic.

## VARIABLES AFFECTING THE LAND PURCHASE DECISION

Presumably, land buyers have a limited planning period and they do consider their opportunity cost of capital (i.e., the rate of return they could earn on alternative investment opportunities that involve a similar amount of risk). Land purchases are usually financed with borrowed capital; thus, credit terms such as interest rates, down payments, and the length of the loan amortization period must be considered. An important, but often overlooked variable is the extent to which expected costs and returns will be reduced by income taxes. Finally, past experience suggests that land prices will

continue to increase in most areas and a capital gain will be realized when the land is sold at the end of the planning period.

This suggests that the land purchase decision can be evaluated using capital budgeting<sup>1</sup>. That is, purchasing a parcel of land is an acceptable investment alternative:

- (1) if the present value of net cash receipts is equal to or greater than the present value of the cash outlays (if the *net present value* is equal to or greater than zero);
- or
- (2) if the *yield* or *internal rate of return* exceeds the opportunity cost of capital.

Capital budgeting is a widely accepted method of evaluating investments in short- and intermediate-term depreciable assets such as machinery [3]. Hopkin, Barry and Baker have illustrated the potential use of capital budgeting for evaluating real estate investments as well [6, Chapter 12].

The hypothetical investment alternative shown in Table 2 illustrates the net-present-value method. In this example, an initial investment outlay of \$1,000 is made at the beginning of year 1 (end of "year 0"). This net cash outlay is followed by net cash inflows of \$500, \$400, \$300, and \$100 received at the end of years 1, 2,

<sup>1</sup>Readers not familiar with capital budgeting procedures are referred to [2], [6, Chapters 9, 10, 11] or [10, Chapter 3] for additional information.

**TABLE 2. ANALYSIS OF A HYPOTHETICAL INVESTMENT USING THE NET-PRESENT-VALUE METHOD**

| (1)                      | (2)                                 | (3)                          | (4)   |
|--------------------------|-------------------------------------|------------------------------|---|
| Time<br>(Year End)       | Cash Inflows (+)<br>and Outlays (-) | 10% Present<br>Value Factors | Present Value<br>of Cash Flows<br>(2) x (3) |
| 0                        | -\$1,000                            | 1.0000                       | -\$1,000                                    |
| 1                        | + 500                               | 0.9091                       | + 454.55                                    |
| 2                        | + 400                               | 0.8264                       | + 330.56                                    |
| 3                        | + 300                               | 0.7513                       | + 255.39                                    |
| 4                        | + 100                               | 0.6830                       | + 68.30                                     |
| Net Present Value = + \$ |                                     |                              | 108.80                                      |

3, and 4. These future cash inflows are discounted to a present value using the 10 percent discount factors in Column 3. The sum of the discounted cash inflows is \$1,108.80. Thus, the net present value of the investment is \$1,108.80 - \$1,000 = + \$108.80. According to the capital budgeting criteria, this would be an acceptable investment alternative because the net present value is greater than zero.

The major cash inflows associated with an investment in real estate consist of the annual net returns to the land (usually estimated from rental rates on comparable parcels in the area), and the returns from selling the land at the end of the planning period. Cash outlays consist of the down payment, principal and interest payments on the mortgage loan, and income taxes. The annual net returns to the land should be regarded as a residual income computed by deducting all production costs, with the exception of interest charges on land debt, from gross receipts. In areas where there is an active rental market, real estate appraisers generally use the net rental or landlord method to estimate this residual return. In areas where renting is less common, a budgeting method can be used. These two methods are illustrated using hypothetical data in Appendix A.

The objective for developing a discounted cash flow model is to provide the land buyer with a method of evaluating a parcel of land using his discount rate, income expectations, credit terms and income tax situation. The variables used are:

- $\bar{P}$  — the average price per acre of recent sales of comparable parcels in the area
- CC — the after-tax opportunity cost of capital
- n — the buyer's planning period in years
- ANI — the expected annual net cash income per acre before taxes

- GNI — the expected annual rate of growth in annual net cash income per acre
- MTR — the buyer's marginal income tax rate (combined federal and provincial rate based on estimated taxable income after the parcel is purchased)
- DP — the proportion of the purchase price paid down (i.e., 1-DP is the proportion of the purchase price financed with borrowed funds)
- IR — the nominal rate of interest charged on the mortgage loan
- t — the amortization period on the loan
- INF — the expected annual rate of inflation in land values
- T\* — the tax rate that will apply to capital gains income in year n when the parcel is sold.<sup>2</sup>
- P\* — the maximum bid price, given values for the preceding 11 variables.

The maximum bid price, P\*, or the price that gives a net present value of zero, is given by<sup>3</sup>:

$$P^* = \left\{ \sum_{i=1}^n \frac{(1+GNI)^i}{(1+CC)^i} (ANI) (1-MTR) + \frac{(1+INF)^n}{(1+CC)^n} (\bar{P}) (1-T^*) \right\} \\ \div \left\{ DP + (1-DP) \left[ \frac{(1+CC)^t - 1}{CC (1+CC)^t} \right] \left[ \frac{IR (1+IR)^t}{(1+IR)^t - 1} \right] \right. \\ \left. - (1-DP) (MTR) (IR) \left[ \frac{IR (1+IR)^t}{(1+IR)^t - 1} \right] \sum_{i=1}^t \frac{1}{(1+CC)^i} \right. \\ \left. \left[ \frac{(1+IR)^{t-i+1} - 1}{IR (1+IR)^{t-i+1}} \right] - \frac{T^*}{(1+CC)^n} \right\}$$

where  $t \leq n$

Although considerably more complicated than the traditional appraisal formula, this equation includes

<sup>2</sup>Since only half of capital gains income is taxable, T\* is equal to half the marginal tax rate that will apply in the year the parcel is sold. T\* was substituted for MTR/2 to allow for the possibility that sale of the property will result in a significantly higher taxable income, and hence, a higher than usual tax rate in year n. T\* is also affected by special provisions in the income tax law such as those that provide for postponement of the capital gains tax when the farm is transferred to a family member. These rollover provisions could reduce the value of T\* to zero.

<sup>3</sup>The mathematical derivation of this equation is given in Appendix B.

most of the major variables that affect the land purchase decision.

## APPLICATION

### Basic Case

A computer program was written to provide a convenient method of solving a basic case and about sixty variations so that the sensitivity of the bid price to changes in the 11 input variables could be examined. In the basic case, a farmer is considering the purchase of an 80-acre parcel of farmland as an add-on unit. From recent sales of comparable parcels in the area, he has observed that land has been selling for an average of \$600 per acre; however, the asking price for this parcel is \$725 per acre.

From his knowledge of rental rates on comparable parcels in the area, he has assumed that this additional land will add \$50 per acre to his annual net cash income before taxes and that this income will increase at an average compound rate of 2 percent per year. He can obtain a 10 percent first mortgage loan for 75 percent of the purchase price, repayable over 20 years in equal annual installments. The income stream from the investment will be subject to a 30 percent marginal tax rate and he estimates that the capital gains tax will total 25 percent of the gain when the property is sold at the end of the 20 year planning period. Land prices are expected to increase from the current average price of \$600 per acre at the rate of 6 percent per year. He estimates that the investment must yield a minimum after-tax rate of return of 10 percent per year.

The input data for the basic case can be summarized as follows:

|           |                          |
|-----------|--------------------------|
| $\bar{P}$ | = \$600 per acre         |
| CC        | = 0.10                   |
| n         | = 20 years               |
| ANI       | = \$50 per acre per year |
| GNI       | = .02 per year           |
| MTR       | = 0.30                   |
| DP        | = 0.25                   |
| IR        | = 0.10 percent per year  |
| t         | = 20 years               |
| INF       | = .06 per year           |
| T*        | = 0.25                   |

The solution for the maximum bid price,  $P^*$ , given these values for the 11 input variables is

$$P^* = \$695 \text{ per acre } (\$694.71 \text{ to be exact})^4$$

<sup>4</sup>Exact amounts were retained in this section to minimize rounding errors.

In other words, this farmer can bid up to \$95 per acre more than the average price of recent sales of comparable parcels in the area and still earn his required 10 percent after-tax rate of return. However, he cannot offer the \$725 asking price unless he is willing to accept a rate of return of less than 10 percent. The \$695-per-acre figure should not be interpreted as an estimate of the price the land will actually sell for. Rather, it is an estimate of the maximum price that this buyer can pay, and his situation and assumptions may or may not be representative of the typical buyer's financial position and income expectations<sup>5</sup>. If he pays the indicated \$695 per acre and his expectations materialize, the cash flows from the investment will be as shown in Table 3.

Column 2 shows the cash outlays for the down payment and mortgage loan payments. The initial cash outlay, the 25 percent down payment of \$173.68, is followed by the 20 annual payments on the \$521.03, 10 percent mortgage loan (19 payments of \$61.22 and a final payment of \$60.08). The decline in the principal balance of the loan and in the interest component of each successive loan payment is shown in Columns 3 and 4.

Column 5 shows the expected income stream of \$50 per year initially, increasing at the rate of 2 percent per year to \$74.30 per acre in year 20. The taxable income in Column 6 is calculated by subtracting the interest in each loan payment from the net income. The income tax, 30 percent of taxable income (MTR), is shown in Column 7. The net cash flows are given in Column 8, and their discounted values are shown in Column 10. As expected, a price of \$694.71 gives a net present value of approximately zero. The 30-cent discrepancy is because of rounding errors.

To the extent that the data used in the basic case are realistic, Table 3 reveals some interesting characteristics of farm real estate investments. Perhaps the most important observation is that after meeting debt servicing charges and income taxes, the net cash flow is negative in all years except in the last year when the parcel is sold. Thus, to feasibly finance the purchase of land, farmers generally must have surplus cash income from other sources, such as land already owned with only a small mortgage against it, or non-farm income.

<sup>5</sup>For example, the assumption that the expected rate of inflation in land values (INF) will be 6 percent if the expected rate of growth in the net income (GNI) is only 2 percent can be questioned. In the absence of non-farm use influences or market imperfections, these two values would be expected to have similar values over the long run.

**TABLE 3. SUMMARY OF DISCOUNTED CASH FLOWS PER ACRE FOR THE BASIC CASE WITH A MAXIMUM BID PRICE OF \$694.71**

| (1) | (2)                      | (3)             | (4)      | (5)            | (6)                          | (7)                       | (8)                             | (9)                       | (10)   | (11)         | (12)               |
|-----|--------------------------|-----------------|----------|----------------|------------------------------|---------------------------|---------------------------------|---------------------------|--|--------------|--------------------|
| n   | Total<br>Loan<br>Payment | Loan<br>Balance | Interest | Cash<br>Inflow | Taxable<br>Income<br>(5)–(4) | Income<br>Tax<br>(6) x .3 | Net Cash<br>Flow<br>(5)–(2)–(7) | 10%<br>Discount<br>Factor | Present<br>Values of<br>Net Cash<br>Flows<br>(9)x(8) | Market Value | Equity<br>(11)–(3) |
| 0   | 173.68 <sup>a</sup>      | 521.03          | —        | —              | —                            | —                         | -173.68                         | 1.0000                    | -173.68  | \$600.00     | 78.97              |
| 1   | 61.22                    | 511.91          | 52.10    | 51.00          | -1.10                        | -.33 <sup>b</sup>         | -9.89                           | .9091                     | -8.99  | 636.00       | 124.09             |
| 2   | 61.22                    | 501.98          | 51.19    | 52.02          | 0.83                         | .25                       | -9.45                           | .8264                     | -7.81  | 674.16       | 172.18             |
| 3   | 61.22                    | 490.85          | 50.19    | 53.06          | 2.87                         | .86                       | -9.02                           | .7513                     | -6.78  | 714.61       | 223.76             |
| 4   | 61.22                    | 478.71          | 49.08    | 54.12          | 5.04                         | 1.51                      | -8.61                           | .6830                     | -5.88  | 757.49       | 278.78             |
| 5   | 61.22                    | 465.36          | 47.87    | 55.20          | 7.33                         | 2.20                      | -8.22                           | .6209                     | -5.10  | 802.94       | 337.58             |
| 6   | 61.22                    | 450.68          | 46.54    | 56.31          | 9.77                         | 2.93                      | -7.84                           | .5645                     | -4.43  | 851.11       | 400.43             |
| 7   | 61.22                    | 434.53          | 45.07    | 57.43          | 12.36                        | 3.71                      | -7.50                           | .5132                     | -3.85  | 902.18       | 467.65             |
| 8   | 61.22                    | 416.76          | 43.45    | 58.58          | 15.13                        | 4.54                      | -7.18                           | .4665                     | -3.35  | 936.31       | 519.55             |
| 9   | 61.22                    | 397.22          | 41.68    | 59.75          | 18.07                        | 5.42                      | -6.89                           | .4241                     | -2.92  | 1,013.69     | 616.47             |
| 10  | 61.22                    | 375.72          | 39.72    | 60.95          | 21.23                        | 6.37                      | -6.64                           | .3855                     | -2.56  | 1,074.51     | 698.79             |
| 11  | 61.22                    | 352.07          | 37.57    | 62.17          | 24.60                        | 7.38                      | -6.43                           | .3505                     | -2.25  | 1,138.98     | 786.91             |
| 12  | 61.22                    | 326.06          | 35.21    | 63.41          | 28.20                        | 8.46                      | -6.27                           | .3186                     | -2.00  | 1,207.32     | 881.26             |
| 13  | 61.22                    | 297.45          | 32.61    | 64.68          | 32.07                        | 9.62                      | -6.16                           | .2897                     | -1.78  | 1,279.76     | 982.31             |
| 14  | 61.22                    | 265.98          | 29.75    | 65.97          | 36.22                        | 10.87                     | -6.12                           | .2633                     | -1.61  | 1,356.54     | 1,090.56           |
| 15  | 61.22                    | 231.36          | 26.60    | 67.29          | 40.69                        | 12.21                     | -6.14                           | .2394                     | -1.47  | 1,437.93     | 1,206.57           |
| 16  | 61.22                    | 193.28          | 23.14    | 68.64          | 45.50                        | 13.65                     | -6.23                           | .2176                     | -1.36  | 1,524.21     | 1,330.93           |
| 17  | 61.22                    | 151.39          | 19.33    | 70.01          | 50.68                        | 15.20                     | -6.41                           | .1978                     | -1.27  | 1,615.66     | 1,464.27           |
| 18  | 61.22                    | 105.31          | 15.14    | 71.41          | 56.27                        | 16.88                     | -6.69                           | .1799                     | -1.20  | 1,712.60     | 1,607.29           |
| 19  | 61.22                    | 54.62           | 10.53    | 72.84          | 62.31                        | 18.69                     | -7.07                           | .1635                     | -1.16  | 1,815.36     | 1,760.74           |
| 20  | 60.08                    | 0               | 5.46     | 74.30          | 68.84                        | 20.65                     | -7.57                           | .1486                     | -1.12  | 1,924.26     | 1,924.26           |
| 20  | (Sale of parcel)         |                 |          |                |                              |                           | 1,616.87 <sup>c</sup>           | .1486                     | +240.27  | —            | —                  |
| SUM | 1,396.94                 | —               | 702.23   | 3,163.40       | 1,766.46                     | 468.46                    | 1,298.77                        | —                         | -\$0.30 <sup>d</sup>                                 | —            | —                  |

<sup>a</sup>Down payment = 25 percent of \$694.71.

<sup>b</sup>The negative income tax assumes that there are other sources of income from which the loss can be deducted.

<sup>c</sup>Sale price (\$1,924.26) – initial cost (\$694.71) = capital gain (\$1,229.55) x T\* (0.25) = Income tax (\$307.39); Net cash flow = Sale price (\$1,924.26) – income tax (\$307.39) = \$1,616.87.

<sup>d</sup>Expected net present value = 0. Difference is due to rounding errors.

Columns 11 and 12 indicate that although the annual net cash income is continually negative, landowners enjoy the benefits of capital gains income. The parcel appreciates at the rate of 6 percent per year from the initial going price ( $\bar{P}$ ) of \$600 per acre to \$1,924.26 at the end of 20 years as shown in Column 11. At the same time the principal balance of the loan declines as shown in Column 3; hence, the owner's equity increases fairly rapidly from \$78.97 per acre to \$1,924.26 per acre. In this example, the buyer's equity will exceed the maximum bid price by the end of the tenth year. Opportunities for converting this growing equity in land to "disposable" income are limited; however, these equity gains should be regarded as part of real income [7, 8].

The basic case also agrees with Crowley's observation that the actual rate of return generally exceeds the

apparent rate of return given by the traditional appraisal formula [4]. According to the formula  $r = I/V$ , the apparent rate of return in this example would be:

$$r = \$50 \div 694.71 = 7.2 \text{ percent.}$$

The actual rate of return is 10 percent, and the 2.8 percent difference is largely because of appreciation in land prices and growth in the net income per acre.

### Variations from the Basic Case

The solution to the basic case was used as a point of departure to examine the response of the maximum bid price to changes in the 11 input variables. Maximum bid price sensitivity was examined by varying the input variables one at a time. Each variable was examined over

the entire possible range (e.g., 0 to 1 for the down payment) or a fairly comprehensive range (e.g., .06 to .14 for the rate of interest on the mortgage loan). In every case, values for all variables other than the one being examined were fixed as specified in the basic case.

Table 4 summarizes the sensitivity of the maximum bid price to changes in the input variables. Generally, the three variables related to expected returns have the greatest effect on the maximum bid price. As the expected rate of inflation (INF) is increased from 0 to 15 percent per year, the maximum bid price increases from \$512 to \$1,782 per acre. P\* is also very responsive to changes in values of the expected annual net income per acre (ANI), and the expected rate of growth in net income per acre (GNI).

The maximum bid price varies inversely with the buyer's opportunity cost of capital (CC). A prospective buyer who is content with a 6 percent after-tax rate of return can bid up to \$941 per acre. However, the maximum

price that corresponds with a 14-percent rate of return is only \$536 per acre.

The terms of financing appear to be fairly important. High down payments and interest rates lead to significant decreases in the maximum bid price. As the interest rate (IR) is increased from 6 to 14 percent per year, the maximum bid price drops to \$590 from \$824 per acre. A buyer who can borrow the full amount of the purchase price at 10 percent per year can bid up to \$742 per acre while the buyer paying cash can earn the 10-percent opportunity cost of capital only if he can buy the parcel for \$584 per acre. This leverage effect will occur only if the opportunity cost of capital exceeds the after-tax rate of interest on the mortgage. In the basic case, the after-tax cost of capital is 10 percent and the after-tax rate of interest on the loan is 7 percent. Thus, for values of CC less than 7 percent, P\* would be highest for a cash purchase (DP=1). In addition to tax deductible interest payments, inflation also encourages

TABLE 4. SENSITIVITY OF MAXIMUM BID PRICE (P\*) TO CHANGES IN THE INPUT VARIABLES

| Input Variables  | Range of<br>Values of<br>Input Variable | Corresponding<br>Range in<br>Maximum<br>Bid Price<br><br>\$ per acre |
|--|---|--|
| <u>A. Terms of mortgage financing</u>                              |   |  |
| Interest rate (IR)   | .06 — .14 per year                      | 824 — 590  |
| Down payment (DP)  | 0 — 1.0                                 | 742 — 584  |
| <u>B. Opportunity cost of<br/>Capital (CC)</u>                     |   |  |
|  | .06 — 0.14 per year                     | 941 — 536  |
| <u>C. Land prices and inflation</u>                                |   |  |
| Average price of comparable<br>parcels (P)                         | \$400 — \$800 per acre                  | 606 — 783  |
| Expected rate of inflation<br>in land values (INF)                 | 0 — 0.15 per year                       | 512 — 1,782  |
| <u>D. Income and tax variables</u>                                 |   |  |
| Income per acre (ANI)  | \$20 — \$100 per acre                   | 437 — 1,124  |
| Growth in net income per<br>acre (GNI)                             | 0 — .06                                 | 633 — 865  |
| Marginal tax rate (MTR)  | 0 — 0.5                                 | 739 — 655  |
| Capital gains tax (T*)   | 0 — 0.25                                | 749 — 695  |
| <u>E. Time horizon and loan<br/>amortization period<br/>(n, t)</u> |   |  |
|  | 5 — 20 — 35 years                       | 653 — 695 — 678  |

the use of credit because the value of the land and the income are increasing while the loan is being repaid with inflated dollars.

Despite the advantages of financial leverage, there are practical limits on the extent to which land purchases can be financed with credit. Large amounts of debt involve greater risks for both the borrower and the lender. The amount of credit that can or should be used depends on the repayment capacity of the total farm business [10, Chapters 4, 9].

The two tax rate variables (MTR and  $T^*$ ) have only a minor effect on the maximum bid price. Varying MTR and  $T^*$  results in comparatively small variations in the maximum bid price. This result occurs because reductions in expected annual net returns per acre due to income taxes are almost completely offset by tax deductible interest payments, especially during the first half of the 20-year investment. The small response of  $P^*$  to changes in the capital gains tax rate ( $T^*$ ) occurs because differences in the net sale price are discounted from 20 years into the future. Changes in  $T^*$  would have a more noticeable effect over a shorter time period and at a lower discount rate.

## CONCLUSIONS

The maximum price that a prospective buyer of farmland can afford to pay is determined by many economic as well as non-economic considerations. Capital budgeting appears to be useful for simultaneously incorporating most of the important economic variables into the decision process.

The maximum bid price is very sensitive to buyers' expectations regarding the rate of inflation in land values. The data in Table 1 indicate that farmland values in Canada increased at an average rate of 8 percent per year over the 1960-74 period. However, wide variations existed in this over-all trend in some years and in some provinces.

The capital budgeting analysis suggests that as high rates of inflation in land values become built into buyers' and sellers' expectations, the result is likely to be even higher rates of inflation. Similarly, a drop in the expected rate of inflation will be quickly reflected in lower bid prices. Thus, several consecutive years of above normal rates of inflation in land values would be followed by several years of comparatively stable prices. Farmland values increased at an average rate of 5 percent per year between 1960 and 1963 (Table 1). From 1963 to 1967 land values increased rapidly at an average rate of nearly

11 percent per year. This period was followed by four consecutive years of below normal rates of inflation in land values when the average price of farmland changed very little, and actually declined between 1969 and 1970. Another period of rapid inflation in land values began in 1972<sup>6</sup>.

Buyers' expectations of annual net income per acre also influence the prices they are willing to pay for land. Thus, higher prices for farm products, increased subsidies, and lower production costs are likely to be capitalized into higher land values fairly quickly. For example, in the basic case an increase of only 10 cents per bushel in the expected price of a crop with an average yield of 100 bushels per acre would increase the expected annual net income per acre from \$50 to \$60. If this \$10 increase is not offset by higher production costs, the maximum bid price would increase from \$695 per acre to \$781 per acre, or by 8.6 times the increase in expected annual net returns per acre.

The sensitivity of the maximum bid price to expected annual net income also explains why established farmers who are buying add-on units can generally outbid beginning farmers. In almost every case the established operator is able to spread his fixed costs over a larger acreage; thus, his expected net income per acre (ANI) will be much higher because the beginning farmer has to allocate all fixed costs to the parcel being purchased. The advantage of established farmers over first-time buyers probably declines as the size of the parcel increases. If the parcel is large enough to constitute a complete farm unit of reasonably efficient size, the beginning farmer's bidding position may be nearly as strong as the established farmer's. This pattern is consistent with Ablasser's finding that small parcels suitable for add-on purposes generally sell at much higher prices per acre than do large parcels [1, p. 213].

There is some evidence that the competitive position of beginning farmers in the land market can be improved through special credit programs such as low down payments and low interest rate loans. For the basic case, lowering the interest rate (IR) from 10 to 8 percent increases the maximum bid price from \$695 to \$756 per acre.

Progressive income tax rates apparently have a minor effect on land prices. Other factors being equal, low-income buyers have a slight advantage over high-income

<sup>6</sup>An analogous response can occur in a local land market. If one parcel sells at an unusually high price, the inflationary expectations of all buyers and sellers in the immediate area are increased and may cause a rapid increase in land prices.

buyers because they are subject to lower marginal tax rates; however, low-income buyers often place a higher opportunity cost on their more limited supply of capital and possibly face higher borrowing costs. These factors will more than offset any advantage the lower marginal tax rates provide. For long planning periods, 15 years or longer, special rollover provisions that may allow postponement of the capital gains tax on transfers to family members (thereby reducing  $T^*$ ) would also appear to have a minor impact on the maximum bid price.

Use of the bid price equation by individual farmers appears to be quite limited. Access to a computer and accurate input data are required. The sensitivity analysis indicates that accurate estimates of expected annual net income (ANI), and the expected rate of inflation in land prices (INF) are especially important in order to obtain reliable estimates of the maximum bid price. Despite the limitations for use by individual farmers, the model may be a potentially useful tool for professional real estate appraisers, lenders, realtors and others who have the necessary data base and computer facilities.

## APPENDIX A

### Hypothetical Illustration of Two Methods of Estimating the Residual Returns to Land

|  | \$ per acre<br>(hypothetical data) |
|--|------------------------------------|
| <b>A. Net Rental Approach</b>  |                                    |
| Average cash rent for comparable land  | 55                                 |
| Less landlord expenses for<br>property taxes, maintenance<br>and insurance   | <u>5</u>                           |
| Net Rental Income  | 50                                 |
| <b>B. Budgeting Approach</b>   |                                    |
| Gross Income (ave. yield x ave. price per bu)  | 150                                |
| Less Operating Costs   |                                    |
| Machinery and labor expenses<br>for planting and harvesting (fuel,<br>repairs, non-mortgage interest, insurance,<br>custom work, etc.) | \$40                               |
| Seed, fertilizer, pesticides, etc.   | 50                                 |
| Transportation, storage and marketing costs  | 5                                  |
| Property taxes and miscellaneous expenses  | <u>5</u>                           |
| Total expenses   | 100                                |
| Residual Return to Land  | <u>50</u>                          |

## APPENDIX B

### Mathematical Derivation of the Land Bid Price Equation

The discounted values of the five cash flow components are derived as follows:

- (1) The initial cash outlay is the proportion of the price paid down multiplied by the purchase price:

$$(DP) (P^*)$$

- (2) The discounted value of the annual net income (or rental) adjusted for income taxes is:

$$\sum_{i=1}^n \frac{1}{(1+CC)^i} (ANI) (1+GNI)^i (1-MTR)$$

$$= \sum_{i=1}^n \frac{(1+GNI)^i}{(1+CC)^i} (ANI) (1-MTR)$$

- (3) The discounted value of the loan payments is calculated by the widely used "level payment" method of loan amortization. The annual payment on a loan of  $\$(1-DP) (P^*)$  amortized in  $t$  years, carrying an interest rate equal to  $IR$  percent per year is:

$$(1-DP) (P^*) \left[ \frac{IR(1+IR)^t}{(1+IR)^t - 1} \right]$$

Thus, the present value of the mortgage loan payments is:

$$\begin{aligned} & \sum_{i=1}^t \frac{1}{(1+CC)^i} (1-DP) (P^*) \left[ \frac{IR(1+IR)^t}{(1+IR)^t - 1} \right] \\ &= P^* (1-DP) \left[ \frac{(1+CC)^t - 1}{CC(1+CC)^t} \right] \left[ \frac{IR(1+IR)^t}{(1+IR)^t - 1} \right] \end{aligned}$$

- (4) Since interest is a tax deductible business expense, the discounted value of the debt servicing charges must be reduced by the amount of the discounted value of tax shield arising from the interest payments. Finding the discounted value of the tax deductions arising from the interest payments is complicated by the use of the level payment amortization plan because the amount of interest paid each year declines as the outstanding principal balance on the loan is reduced.

For a loan of  $\$(1-DP) P^*$  that is amortized in equal annual installments over a period of  $t$  years, the principal balance outstanding at the beginning of any year,  $i$ , is the present value of the remaining annual payments, discounted at the rate of interest being charged on the loan, or:

$$(1-DP) (P^*) \left[ \frac{IR(1+IR)^t}{(1+IR)^t - 1} \right] \left[ \frac{(1+IR)^{t-i+1} - 1}{IR(1+IR)^{t-i+1}} \right]$$

Thus, the interest component of the payment made at the end of any year,  $i$ , is:

$$(IR) (1-DP) (P^*) \left[ \frac{IR(1+IR)^t}{(1+IR)^t - 1} \right] \left[ \frac{(1+IR)^{t-i+1} - 1}{IR(1+IR)^{t-i+1}} \right]$$

Since this interest is tax deductible, the borrower's income taxes in any year,  $i$ , are reduced by:

$$(MTR) (IR) (1-DP) (P^*) \left[ \frac{IR(1+IR)^t}{(1+IR)^t - 1} \right] \left[ \frac{1+IR^{t-i+1} - 1}{IR(1+IR)^{t-i+1}} \right]$$

The present value of the tax savings arising from all interest payments made over the amortization period is given by:

$$\begin{aligned} & (P^*) (1-DP) (MTR) (IR) \left[ \frac{IR(1+IR)^t}{(1+IR)^t - 1} \right] \\ & \sum_{i=1}^t \frac{1}{(1+CC)^i} \left[ \frac{(1+IR)^{t-i+1} - 1}{IR(1+IR)^{t-i+1}} \right] \end{aligned}$$

- (5) At the end of the planning period, assume that the land will be sold. If comparable land in the area is now selling at an average of  $\$P$  per acre, the expected sale price at the end of  $n$  years is:

$$\bar{P} (1 + INF)^n$$

For unimproved land, it is reasonable to assume that the cost basis for purposes of calculating the capital gain is the purchase price,  $P^*$ . Hence, the amount of tax due when the parcel is sold will be:

$$T^* \left( \bar{P} (1+INF)^n - P^* \right)$$

where  $T^*$  is half of the estimated marginal tax rate that will apply in the year the parcel is sold.

The present value of the net, after-tax proceeds from selling the property at the end of  $n$  years is:

$$\frac{1}{(1+CC)^n} \left[ \bar{P} (1+INF)^n - T^* \left( \bar{P} (1+INF)^n - P^* \right) \right]$$

$$= \frac{P^* T^*}{(1+CC)^n} + \frac{(1+INF)^n}{(1+CC)^n} \left( \bar{P} \right) \left( 1 - T^* \right)$$

According to the capital budgeting criteria, purchase of the parcel of land is an acceptable investment if the net present value is equal to or greater than zero. In this case, the maximum purchase price would be the price that gives a net present value equal to zero. Setting the sum of the discounted cash inflows and the discounted cash outflows equal to zero gives:

$$-DP(P) + \sum_{i=1}^n \frac{(1+GNI)^i}{(1+CC)^i} (ANI) (1-MTR)$$

$$-P^* (1-DP) \left[ \frac{(1+CC)^t - 1}{CC(1+CC)^t} \right] \left[ \frac{IR(1+IR)^t}{(1+IR)^t - 1} \right]$$

$$+ P^* (1-DP) (MTR) (IR) \left[ \frac{IR(1+IR)^t}{(1+IR)^t} \right] \sum_{i=1}^t \frac{1}{(1+CC)^i}$$

$$\left[ \frac{(1+IR)^{t-i+1} - 1}{IR(1+IR)^{t-i+1}} \right] + \frac{P^* T^*}{(1+CC)^n}$$

$$+ \frac{(1+INF)^n}{(1+CC)^n} (\bar{P}) (1 - T^*) = 0$$

Since the primary objective is to determine the maximum bid price, rearranging terms and solving for  $P^*$  gives:

$$P^* = \left\{ \sum_{i=1}^n \frac{(1+GNI)^i}{(1+CC)^i} (ANI) (1-MTR) \right.$$

$$+ \left. \frac{(1+INF)^n}{(1+CC)^n} (\bar{P}) (1 - T^*) \right\}$$

$$\div \left\{ DP + (1-DP) \left[ \frac{(1+CC)^t - 1}{CC(1+CC)^t} \right] \left[ \frac{IR(1+IR)^t}{(1+IR)^t - 1} \right] \right.$$

$$- (1-DP) (MTR) (IR) \left[ \frac{IR(1+IR)^t}{(1+IR)^t - 1} \right] \sum_{i=1}^t \frac{1}{(1+CC)^i}$$

$$\left[ \frac{(1+IR)^{t-i+1} - 1}{IR(1+IR)^{t-i+1}} \right] - \frac{T^*}{(1+CC)^n} \left\}$$

## REFERENCES

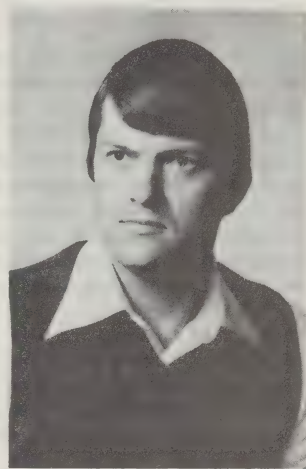
1. Ablasser, G., *Farm Real Estate Sales in the Prairie Provinces*, 1963-67, Publ. No. 6916, Economics Branch, Agriculture Canada, March 1969, pp. 213-14.
2. Aplin, Richard D. and Casler, George L., *Capital Investment Analysis: Using Discounted Cash Flows*, Columbus, Ohio, Grid, 1973.
3. Batterham, R.L., "Analysis of Machinery Investment and Financing Using Capital Budgeting", *Canadian Farm Economics*, Vol. 9, No. 2, Economics Branch, Agriculture Canada, April 1974, pp. 28-37.
4. Crowley, William D., "Actual Versus Apparent Rate of Return on Farmland Investment". *Agricultural Finance Review*, Vol. 35, Economic Research Service, United States Department of Agriculture, October 1974, pp. 52-57.
5. Farm Credit Corporation, *Federal Farm Credit Statistics*, Ottawa, 1975, p. 52.
6. Hopkin, John A., Barry, Peter J. and Baker, C.B., *Financial Management in Agriculture*. Danville, Illinois, The Interstate Printers and Publishers, 1973.
7. Huff, H.B. and Cusack, T.J., *Capital Gains in Canadian Agriculture*, 1946-66. Publ. No. AE/72/1. University of Guelph, School of Agricultural Economics and Extension Education, January 1972.
8. McClatchy, D. and Campbell, C. "An Approach to Identifying the Low-Income Farmer". *Canadian Farm Economics*, Vol. 10, No. 2, Economics Branch, Agriculture Canada, April 1975, pp. 1-11.
9. Murray, William G., *Farm Appraisal and Valuation*, 5th ed., Ames, Iowa State University Press, 1969.
10. Nelson, Aaron G., Lee, Warren F., and Murray, William G., *Agricultural Finance*, 6th ed., Ames, Iowa State University Press, 1973, pp. 41-65, 132-47.

# TRENDS IN CATTLE AND CALF MARKETINGS AT PUBLIC STOCKYARDS



*Public stockyard receipts of cattle and calves have been declining in the past 20 years in relation to other marketing methods (direct selling). This decrease in stockyard activity suggests that the reliability of market information generated at stockyards may be deteriorating. This may have serious implications for the pricing performance of the entire cattle market.*

J.C. Lowe & T.M. Petrie\*



## INTRODUCTION

Public stockyards or terminal markets are the primary source of daily marketing information upon which many other live cattle marketing decisions are based.<sup>1</sup> The significant decline in public stockyard receipts of cattle and calves relative to other sales methods over the past two decades suggests that the reliability of the market information generated at public yards may be deteriorating. This in turn may have serious implications for the pricing performance of the entire market.<sup>2</sup> As the downward trend in terminal market sales continues, cyclical, seasonal and daily variations become even more critical in terms of the price formation process. The sample of sales at terminal markets may be too small at times to be representative of all sales within a particular area or a particular class or grade of animal, i.e., to

represent a truly competitive price. As a result it may be necessary to develop new information sources and methods of collection in order to preserve the pricing performance of the market.

The slaughter cattle and calf trade at public stockyards has declined relative to an increasing inspected slaughter volume over the past two decades. In 1974, about 1.1 million head of slaughter cattle and calves were marketed through public stockyards, constituting about 32 percent of federally-inspected cattle and calf slaughter. The proportion was 52 percent in 1955. Stockyard receipts of slaughter cattle alone accounted for approximately 30 percent of the 1974 inspected cattle slaughter and 61 percent of the 1955 slaughter.

Several reasons for the trend toward more direct forms of marketing have been suggested, including: improved transportation, re-location of packing plants away from the public stockyards, revision of the beef grading system, inflexible marketing charges, increasing size and specialization of producers, and grade and yield evaluation errors associated with live cattle selling (4), (5).

In a recent survey of prairie cattle producers, market information was rated among the three most important marketing problems by one third of all respondents.<sup>3</sup>

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<sup>1</sup> There are nine markets in Canada designated as public stockyards (terminal markets) by the Minister of Agriculture and regulated under the Livestock and Livestock Products Act. They are Calgary, Edmonton, Lethbridge, Prince Albert, Regina, Saskatoon, Winnipeg, Toronto and Montreal. Direct marketing of cattle, as used in this article, refers to all sales other than those to public stockyards and includes: direct producer-to-plant sales, auction market sales and deliveries via dealers or other market intermediaries.

<sup>2</sup> Both the relationship between market performance and market information, and the trade-off between pricing and operational efficiency in markets, is well documented in the literature, both theoretically and in an applied sense. See for example: (1), (2), (3), (4).

<sup>3</sup> A mail questionnaire survey of 1,215 cattle producers in the three prairie provinces was conducted in the spring of 1975. Complete details and results of the survey will be reported in a forthcoming Agriculture Canada publication.

Since much of the market information available to producers is derived from public stockyard activity, this suggests a developing problem associated with declining public stockyard volumes.

This presentation examines the trends in annual cattle and calf marketings at public stockyards by class for the 1955-74 period. The 1953-72 period is used for the trend analysis by grade because of the change in Canada's beef grading system in 1972. Past trends are projected, assuming linear relationships, to 1980, 1985 and 1990 for all markets and selected classes of animals. In addition, an assessment is made of the effectiveness of certain markets as a source of price information — given the past and projected marketing trends.

While annual data form the basis of this analysis, data for shorter periods were used in assessing the price implications of changing marketing patterns. The Agriculture Canada publications "Livestock Market Review" and "Livestock and Meat Trade Report" are the main data sources.

## GENERAL MARKETING TRENDS, 1955-74

Reflecting the combined individual market trends, total cattle receipts at public stockyards in Canada showed a very modest upward trend of about 5 percent from the first to the last half of the 1955-74 period (Table 1). A

sharp increase in the relatively small number of feeder cattle sales more than offset the small decrease in the larger volume of slaughter cattle marketings at public stockyards (Figure 1). The same thing occurred in calf marketings (Figure 1 and Table 2). Starting at a similar average level in the 1955-64 period, a pronounced rise in stocker or feeder calf receipts more than compensated for the 19-percent decrease in veal, butcher or slaughter calf sales at stockyards. The total stockyard trade in calves increased 21 percent from 1955-64 to 1965-74.

Inspected cattle slaughter has increased sharply while the public stockyard receipts of slaughter cattle have declined in Canada over the past 20 years. The resulting upward trend in direct-to-plant deliveries has occurred across Canada, but has been greatest in the West. A comparison of the 1955 and 1974 "off-yard" sales of slaughter cattle with inspected slaughter shows that the proportion of direct deliveries has increased from 43 to 81 percent in Alberta; from 58 to 78 percent in Saskatchewan; from 41 to 62 percent in Manitoba; from 39 to 51 percent in Ontario; and from 38 to 42 percent in Quebec. The increase for Canada was from 42 to 67 percent.

A greater proportion of the inspected calf slaughter moved directly to packing plants in Saskatchewan and Quebec between 1955 and 1974; however, the opposite

**TABLE 1. ANNUAL AVERAGE RECEIPTS OF SLAUGHTER, FEEDER AND TOTAL CATTLE AT PUBLIC STOCKYARDS IN CANADA, 1955-64 AND 1965-74**

| Market               | Average<br>1955-64 |        |         | Average <sup>a</sup><br>1965-74 |        |         | Change    |        |       |
|----------------------|--------------------|--------|---------|---------------------------------|--------|---------|-----------|--------|-------|
|                      | Slaughter          | Feeder | Total   | Slaughter                       | Feeder | Total   | Slaughter | Feeder | Total |
|                      | — thousand head —  |        |         |                                 |        |         | %         | %      | %     |
| Calgary              | 208.7              | 64.2   | 272.9   | 187.0                           | 65.1   | 252.1   | -10       | + 1    | - 8   |
| Edmonton             | 91.4               | 73.5   | 164.9   | 93.0                            | 144.1  | 237.1   | + 2       | + 96   | +44   |
| Lethbridge           | 37.3               | 19.4   | 56.7    | 15.4                            | 14.1   | 29.5    | -59       | - 27   | -48   |
| Prince Albert        | 17.5               | 11.6   | 29.1    | 25.5                            | 29.2   | 54.7    | +46       | +152   | +88   |
| Regina               | 26.0               | 16.0   | 42.0    | 29.0                            | 30.2   | 59.2    | +12       | + 89   | +41   |
| Saskatoon            | 62.8               | 30.0   | 92.8    | 54.8                            | 43.2   | 98.0    | -13       | + 44   | + 6   |
| Winnipeg             | 189.4              | 87.8   | 277.2   | 163.1                           | 79.1   | 242.2   | -14       | - 10   | -13   |
| Toronto              | 347.5              | 62.2   | 409.7   | 380.3                           | 81.2   | 461.5   | + 9       | + 30   | +13   |
| Montreal             | 100.6              | —      | 100.6   | 79.1                            | —      | 79.1    | -21       | —      | -21   |
| Nine Market<br>Total | 1,081.4            | 364.5  | 1,445.9 | 1,027.4                         | 486.4  | 1,513.8 | - 5       | + 33   | + 5   |

<sup>a</sup>The values for 1973 and 1974 used in the averages are disposals from public stockyards.

Source: "Livestock Market Review", Production and Marketing Branch, Agriculture Canada, annual.

TABLE 2. ANNUAL AVERAGE RECEIPTS OF VEAL AND BUTCHER, FEEDER AND STOCKER, AND TOTAL CALVES AT PUBLIC STOCKYARDS IN CANADA, 1955-64 AND 1965-74.

| Market               | Average<br>1955-64 |        |                   | Average <sup>a</sup><br>1965-74 |        |       | Change    |        |       |
|----------------------|--------------------|--------|-------------------|---------------------------------|--------|-------|-----------|--------|-------|
|                      | Slaughter          | Feeder | Total             | Slaughter                       | Feeder | Total | Slaughter | Feeder | Total |
|                      |                    |        | — thousand head — |                                 |        |       | %         | %      | %     |
| Calgary              | 10.0               | 44.5   | 54.5              | 2.7                             | 45.6   | 48.3  | -73       | + 2    | - 11  |
| Edmonton             | 15.8               | 24.0   | 39.8              | 12.4                            | 88.2   | 100.6 | -22       | +268   | +153  |
| Lethbridge           | .7                 | 14.7   | 15.4              | —                               | 12.4   | 12.4  | —         | - 16   | - 20  |
| Prince Albert        | 1.8                | 5.7    | 7.5               | 1.2                             | 22.1   | 23.3  | -33       | +288   | +211  |
| Regina               | 3.6                | 7.6    | 11.2              | 2.1                             | 18.0   | 20.1  | -42       | +137   | + 79  |
| Saskatoon            | 5.7                | 12.0   | 17.7              | 2.7                             | 33.8   | 36.5  | -53       | +182   | +106  |
| Winnipeg             | 51.3               | 55.8   | 107.1             | 28.8                            | 99.4   | 128.2 | -44       | + 78   | + 20  |
| Toronto              | 70.5               | 27.0   | 97.5              | 82.1                            | 33.0   | 115.1 | +16       | + 22   | + 18  |
| Montreal             | 102.8              | 19.2   | 122.0             | 79.7                            | 7.4    | 87.1  | -23       | - 62   | - 29  |
| Nine Market<br>Total | 262.2              | 210.6  | 472.8             | 211.7                           | 360.0  | 571.7 | -19       | + 71   | + 21  |

<sup>a</sup>The values for 1973 and 1974 used in the averages are disposals from public stockyards.

Source: "Livestock Market Review", Production and Marketing Branch, Agriculture Canada, annual.

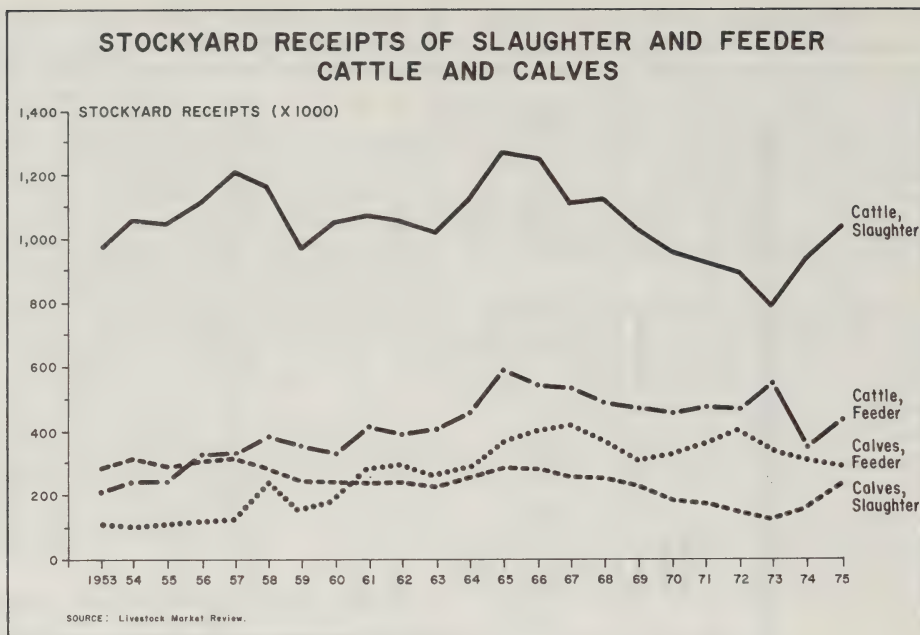


Figure 1

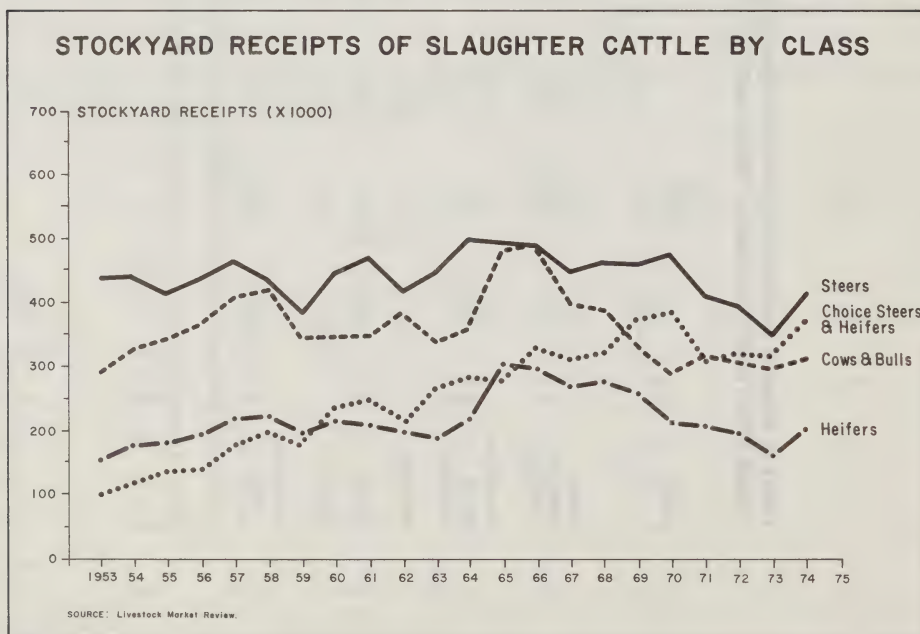


Figure 2

## COMPOSITION OF SLAUGHTER CATTLE RECEIPTS AT PUBLIC STOCKYARDS<sup>1/</sup>

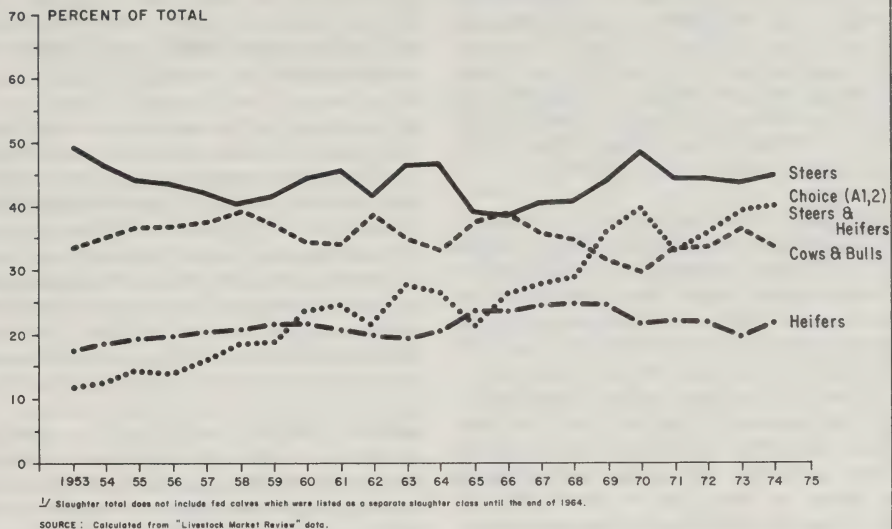


Figure 3

## SLAUGHTER CATTLE MARKETED AT PUBLIC STOCKYARDS, ACTUAL AND ESTIMATED\*

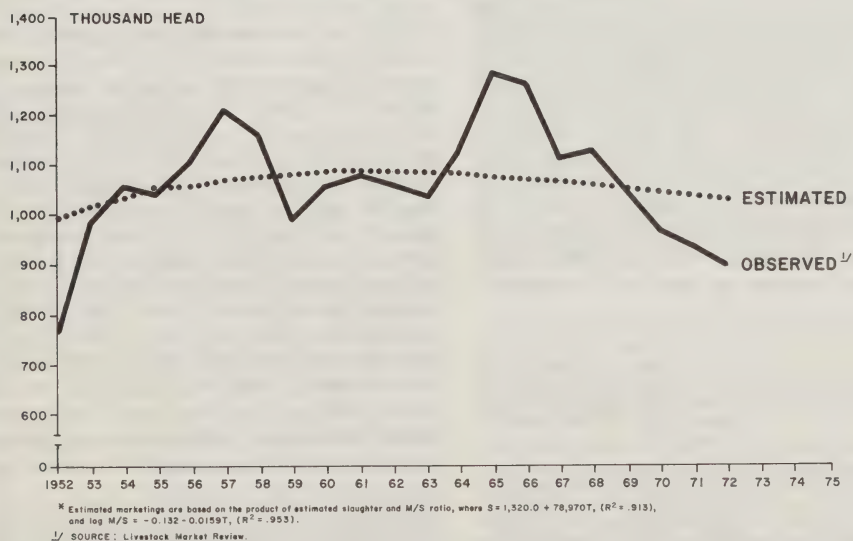


Figure 4

trend occurred in Alberta, Manitoba and Ontario. These changes occurred simultaneously with the decrease in both the numbers of calves slaughtered and the numbers of slaughter calves sold directly in all five provinces. Reflecting the trend in Quebec, where 60 percent of the 1974 Canadian inspected calf slaughter was recorded, the percentage of direct deliveries of slaughter calves showed an upward trend in Canada. Direct sales rose from 62 to 72 percent of the total inspected calf slaughter in Canada between 1955 and 1974.

There has been a general increase in the proportion of feeder animals in the total stockyard receipts of cattle in Canada, from a 1955-64 average of 25 percent to a 1965-74 average of 32 percent. This is the result of the uptrend in feeder cattle sales at most stockyards and the rise in direct-to-plant deliveries of slaughter cattle across Canada. Since the mid-sixties, however, stockyard receipts of feeder cattle have declined relative to total slaughter the same year or lagged one year<sup>4</sup>. This downward trend may reflect the increased use of alternative marketing methods for feeder cattle such as auction marts, dealers, and direct sales to other farmers and feedlots. It may also be indicative of the general trend in total feeder cattle sales, by all methods, relative to total slaughter. Until 1974, there was a rise in the use of lighter animals (feeder calves) as feedlot replacements — because of rising grain stocks and declining grain prices between 1965 and 1972.

The marketing of calves for slaughter has decreased in most areas of Canada because of the increased feeding of calves to mature slaughter weights. However, as indicated earlier, total stockyard receipts of calves have risen with the expansion of the feeder component of total sales. While lack of data makes it difficult to determine the effect of certain trend factors<sup>5</sup>, there appears to have been a real increase in the number of calves appearing in stockyard statistics as stocker or feeder calves. Comparing total stocker calf marketings at stockyards in one year with the total inspected cattle slaughter the following year shows such an increase —

from 6 percent in 1955 to 15 percent in 1967 and 13 percent in 1974. Similar results are obtained using a two-year lag.

## **CATTLE MARKETINGS BY CLASS AND GRADE, 1953-72**

An examination of the annual average slaughter cattle marketings at Canadian public stockyards shows there were respective increases of 6, 23 and 4 percent in slaughter steer, heifer and cow receipts between the 1953-62 and 1963-72 periods<sup>6</sup>. Bull sales, on the other hand, dropped 12 percent. The heifer class, however, was the only one of the four slaughter classes to display an increase relative to the total stockyard trade in slaughter cattle. Receipts of the choice grade and good heifers rose, but those of good steers and the medium and common grades declined over the two periods.

Similarly, stockyard receipts of the medium and common grades decreased while those of the choice grade increased relative to total slaughter cattle sales. Deliveries of good steers declined in relation to the total while those of good grade heifers increased.

While the above describes the trend in marketings for the nine stockyards in total, there was considerable variation by market in the cattle sales by class and grade. The individual market trends will not be described here but are shown in Tables 1, 2 and 3 of the Appendix.

In 1953, there were about the same proportions of steers and heifers, cows, and bulls in both the public stockyard receipts of slaughter cattle and the total inspected cattle slaughter for Canada. As marketing patterns changed between 1953 and 1972, differences began to develop in the composition of stockyard sales in relation to inspected slaughter. When public stockyard receipts of slaughter cattle are taken as a percentage of total inspected cattle slaughter for the respective classes and grades, an increase in direct deliveries is indicated for all categories examined here except bulls. Public stockyards accounted for approximately 60 percent of the bulls sold to federally-inspected packing plants in 1953, and about 65 percent in 1972. For slaughter steers and heifers, about 38 percent of the choice grade, 70 percent of the good grade, and 62 percent of the combined medium and common grades were marketed through stockyards in 1953. The respective 1972 values were 22,

<sup>4</sup> A comparison of the 1965 and 1973 public stockyard receipts of feeder cattle with the 1966 and 1974 inspected cattle slaughter, respectively, showed that feeder cattle marketings declined relative to total cattle slaughter from 22 percent in the mid-1960's to 15 percent in the mid-1970's.

<sup>5</sup> Stockyard marketings of calves are influenced by such factors as the growth in the use of auction markets and special seasonal sales, the direct sales between cow-calf operators and cattle feeders, and the number of calves being raised as heavier feeders or to slaughter weights — on the same farm on which they were born — before being marketed. For example, there has been a shift from a cow-yearling to a cow-calf operation in this period, which has influenced the type of feeder animal marketed.

<sup>6</sup> These percentage increases may slightly overestimate the actual change that has occurred because there was a separate category reported for fed calves until 1964. In 1965, fed calves were combined with their respective classes of slaughter cattle. The 1955-64 annual average fed calf slaughter was 75,200 head.

28 and 40 percent. The good grade showed the largest relative increase in direct sales with a very large absolute increase occurring for choice steers and heifers. Direct deliveries of all grades of steers and heifers increased from 42 to 74 percent of the total. Approximately 38 percent of the 1953 marketings and 53 percent of the 1972 marketings of slaughter cows by-passed public stockyards.

The trend toward direct selling also pervades the U.S. cattle market. In 1973, U.S. packers purchased about 73 percent of all cattle and 31 percent of all calves directly from producers, dealers or other sources where cattle did not pass through either terminal or auction markets. Of the remaining slaughter cattle, 11.9 percent were purchased at U.S. terminals and 15.1 percent at auction markets. Slaughter calf purchases were mainly through auction markets (61 percent) with the remaining 8 percent at terminal yards. The 10 major packers in the United States obtained a somewhat higher percentage of their cattle directly (88.5 percent) and significantly more slaughter calves at auction markets (76.2) than all packers as a group. Also, U.S. packers purchased 23.4 percent of their cattle on a grade and weight basis in 1973, an increase of 13.4 percent since 1964.

The above proportions are part of a 30-year trend in the United States, which, between 1969 and 1973, saw direct purchases increase from 63 to 73 percent, terminal market purchases decline from 21 to 12 percent, and auctions market sales hold their own at about 15 percent of total cattle receipts (6).

## PROJECTED MARKETING TRENDS AT PUBLIC STOCKYARDS

Least squares estimates of the 1952-72 trends, using data in actual and logarithmic form, provided the basis of the stockyard marketing projections to 1980, 1985 and 1990. Using individual stockyard receipts and total federally-inspected slaughter statistics for the corresponding provinces, time relationships in the marketing/slaughter (M/S) ratios were determined for selected classes and grades of cattle by market<sup>7</sup>. The M/S ratio projections were then combined with provincial slaughter projections to estimate future marketing trends for the individual stockyards, and in total. Slaughter projections were also estimated by extrapolation of

simple linear time trends. M/S ratios replaced actual marketing volumes in the linear trend estimates because they provided the best fit in nearly all cases, the exceptions being choice slaughter heifers and feeder cattle.

One drawback of the present analysis is that the use of a linear trend does not take the seasonal and cyclical nature of cattle production and slaughter into account. That is, projections are merely mid-points along a cyclical path. The period chosen incorporates two complete cycles with starting and ending points in opposite phases of the cycle so as to avoid biasing the estimated trend lines and their projections. Secondly, the projections are of an "other things remaining equal" nature. For example, public stockyards may change their services, charges or operations in response to present trends, which may reverse or alter these trends. Such innovations as trading slaughter cattle at public stockyards on the basis of yield and grade at the point of slaughter, and selling cattle that have been consigned by description rather than delivered, have been suggested<sup>(7)</sup>.

The analysis of the 1952-72 trend showed that the public stockyard marketings of slaughter cattle were declining at an annual rate of about 5.2 percent. Given current slaughter levels, this amounts to a decline of about 46 thousand head annually. Steer and heifer marketings, which constitute about 75 to 80 percent of total slaughter, account for much of the current annual decline. It may also be noted that, except for cows and choice heifers, the stockyard marketings of all classes of cattle showed a significant downward trend relative to respective slaughter totals at eight of the nine public stockyards<sup>8</sup>. The Prince Albert public stockyard was the exception<sup>9</sup>. The proportions of choice steers and choice heifers marketed both showed significant upward trends relative to the total Saskatchewan slaughter of these animals<sup>10</sup>. Only the total slaughter cow category revealed a significant downward trend at this market.

<sup>8</sup>Only at Calgary, Lethbridge, Montreal and Prince Albert were the trends in cow marketings statistically significant. The Montreal market was the only one of the five to show an upward trend in cow sales.

<sup>9</sup>The Prince Albert market has not experienced some of the changes in factors influencing terminal marketing.

<sup>10</sup>The failure to isolate a statistically significant trend for choice heifer receipts at most other stockyards may be related to the method used to measure trend in the choice heifer series. Choice heifer marketings were compared with total steer and heifer slaughter in measuring trend. A ratio of choice heifer marketings to total heifer slaughter may have provided better results. This ratio may have reflected cyclical breeding herd expansion and contraction more accurately and therefore may have explained more of the variation in heifer marketings relative to slaughter.

<sup>7</sup>All trend equations are of the form  $Y$  or  $\log Y = a + bT$ , where  $Y$  is the marketings or marketings/slaughter ratio and  $T = \text{time}$  (1952-72). The semi-log function never declines to zero and for negative time trends becomes flatter as  $T$  increases. Except when otherwise noted Time explained from 60 to 95 percent of the variation in the dependent variable. (Most  $R^2$  values were greater than .80).

Table 3 shows the slaughter cattle marketing projections for 1974, 1980, 1985 and 1990. These are the combined projected linear trends in the marketing/slaughter ratios by market and in the cattle slaughter by province. The results suggest that the Lethbridge market may not be receiving sufficient volumes of slaughter cattle to remain open by the year 1990. Projections for the Calgary, Edmonton and Winnipeg markets show substantial declines over the 17-year period. Most other markets are also projected to have declining slaughter cattle market volumes; however, Prince Albert might expand operations in the next two decades. Since slaughter is expected to increase, markets in all provinces will likely record a decline in receipts relative to total inspected slaughter.

**TABLE 3. PROJECTED MARKETINGS AT PUBLIC STOCKYARDS, 1974-90**

| Market/Class of Cattle <sup>a</sup> | 1974 <sup>b</sup> Actual | Projections |       |       |       |
|-------------------------------------|--------------------------|-------------|-------|-------|-------|
|                                     |                          | 1974        | 1980  | 1985  | 1990  |
| — thousand head —                   |                          |             |       |       |       |
| <b>Nine Markets</b>                 |                          |             |       |       |       |
| Choice Steers                       | 327.6                    | 251.1       | 252.9 | 246.6 | 235.6 |
| All Steers                          | 412.8                    | 391.3       | 267.0 | 117.2 | —     |
| Choice Heifers                      | 149.1                    | 120.1       | 152.3 | 157.6 | 163.0 |
| All Steers and Heifers              | 613.5                    | 626.5       | 402.0 | 342.7 | 104.7 |
| Cows                                | 275.9                    | 325.8       | 329.4 | 332.1 | 334.6 |
| Total Slaughter                     | 922.5                    | 997.1       | 921.3 | 851.1 | 778.6 |
| <b>Lethbridge</b>                   |                          |             |       |       |       |
| Choice Steers                       | 1.3                      | 2.7         | 1.1   | 0.5   | 0.3   |
| All Steers                          | 1.5                      | 3.8         | 1.8   | 0.9   | 0.5   |
| Choice Heifers                      | 1.1                      | 2.9         | 2.1   | 1.7   | 1.4   |
| All Steers and Heifers              | 2.8                      | 6.1         | 3.0   | 1.6   | 0.8   |
| Cows                                | 3.3                      | 4.0         | 2.8   | 2.1   | 1.5   |
| Total Slaughter                     | 6.5                      | 10.2        | 5.4   | 3.1   | 1.7   |
| <b>Calgary</b>                      |                          |             |       |       |       |
| Choice Steers                       | 67.7                     | 63.6        | 45.1  | 36.5  | 29.0  |
| All Steers                          | 71.1                     | 74.6        | 54.7  | 40.2  | 28.9  |
| Choice Heifers                      | 33.6                     | 36.3        | 31.8  | 30.9  | 29.3  |
| All Steers and Heifers              | 108.5                    | 83.9        | 64.1  | 48.7  | 36.3  |
| Cows                                | 42.5                     | 35.2        | 31.6  | 28.4  | 25.3  |
| Total Slaughter                     | 157.0                    | 163.9       | 126.8 | 99.4  | 76.4  |
| <b>Edmonton</b>                     |                          |             |       |       |       |
| Choice Steers                       | 15.6                     | 5.7         | —     | —     | —     |
| All Steers                          | 17.3                     | 20.5        | 13.0  | 8.4   | 5.4   |
| Choice Heifers                      | 12.6                     | 12.3        | 15.6  | 18.4  | 21.2  |
| All Steers and Heifers              | 31.7                     | 38.2        | 26.3  | 18.4  | 12.5  |
| Cows                                | 29.0                     | 38.8        | 44.0  | 48.4  | 52.8  |
| Total Slaughter                     | 66.8                     | 74.1        | 55.7  | 42.6  | 32.1  |
| <b>Prince Albert</b>                |                          |             |       |       |       |
| Choice Steers                       | 11.1                     | 19.1        | 19.0  | 18.3  | 17.1  |
| All Steers                          | 12.8                     | 17.0        | 20.4  | 23.2  | 26.1  |
| Choice Heifers                      | 3.3                      | —           | —     | —     | —     |
| All Steers and Heifers              | 17.7                     | 23.3        | 27.9  | 31.6  | 35.4  |
| Cows                                | 7.2                      | 7.4         | 8.2   | 8.9   | 9.6   |
| Total Slaughter                     | 24.1                     | 26.7        | 28.4  | 29.4  | 30.0  |

**TABLE 3. PROJECTED MARKETINGS AT PUBLIC STOCKYARDS, 1974-90 (continued)**

| Market/Class of Cattle <sup>a</sup> | 1974 <sup>b</sup> Actual | Projections |       |       |       |
|-------------------------------------|--------------------------|-------------|-------|-------|-------|
|                                     |                          | 1974        | 1980  | 1985  | 1990  |
| — thousand head —                   |                          |             |       |       |       |
| <b>Regina</b>                       |                          |             |       |       |       |
| Choice Steers                       | 6.9                      | 5.3         | 4.4   | 5.0   | 4.6   |
| All Steers                          | 7.3                      | 7.6         | 6.4   | 5.4   | 4.5   |
| Choice Heifers                      | 5.3                      | 3.5         | 11.1  | 14.5  | 16.4  |
| All Steers and Heifers              | 13.4                     | 16.2        | 15.1  | 14.0  | 12.8  |
| Cows                                | 14.2                     | 13.1        | 14.6  | 15.9  | 17.2  |
| Total Slaughter                     | 26.0                     | 29.4        | 28.2  | 26.8  | 25.1  |
| <b>Saskatoon</b>                    |                          |             |       |       |       |
| Choice Steers                       | 18.7                     | 12.4        | 10.8  | 9.3   | 7.8   |
| All Steers                          | 21.6                     | 13.7        | —     | —     | —     |
| Choice Heifers                      | 9.2                      | 4.4         | 3.8   | 2.8   | 1.2   |
| All Steers and Heifers              | 34.2                     | 34.4        | 29.1  | 24.7  | 20.7  |
| Cows                                | 13.3                     | 16.0        | 16.1  | 16.1  | 15.9  |
| Total Slaughter                     | 49.3                     | 52.7        | 46.4  | 40.9  | 35.7  |
| <b>Winnipeg</b>                     |                          |             |       |       |       |
| Choice Steers                       | 51.1                     | 32.3        | 30.2  | 25.4  | 17.5  |
| All Steers                          | 60.2                     | 70.2        | 62.5  | 52.5  | 39.4  |
| Choice Heifers                      | 15.6                     | 4.5         | —     | —     | —     |
| All Steers and Heifers              | 82.5                     | 95.1        | 79.1  | 59.9  | 35.6  |
| Cows                                | 45.1                     | 50.2        | 47.3  | 44.3  | 41.5  |
| Total Slaughter                     | 133.9                    | 149.5       | 133.3 | 120.3 | 108.1 |
| <b>Toronto</b>                      |                          |             |       |       |       |
| Choice Steers                       | 155.0                    | 86.1        | 75.4  | 56.9  | 28.7  |
| All Steers                          | 217.5                    | 202.0       | 217.5 | 227.8 | 236.0 |
| Choice Heifers                      | 68.5                     | 61.2        | 99.8  | 140.2 | 184.9 |
| All Steers and Heifers              | 317.9                    | 305.0       | 329.7 | 346.5 | 360.3 |
| Cows                                | 67.4                     | 57.6        | 54.2  | 53.4  | 52.6  |
| Total Slaughter                     | 393.4                    | 373.3       | 366.5 | 356.6 | 343.8 |
| <b>Montreal</b>                     |                          |             |       |       |       |
| Choice Steers                       | 0.2                      | 0.9         | 0.6   | 0.4   | 0.3   |
| All Steers                          | 3.5                      | 4.7         | 1.4   | —     | —     |
| Choice Heifers                      | 0.0                      | 2.2         | 0.6   | —     | —     |
| All Steers and Heifers              | 4.8                      | 7.5         | 2.6   | —     | —     |
| Cows                                | 53.9                     | 63.5        | 55.0  | 44.2  | 30.1  |
| Total Slaughter                     | 65.5                     | 80.5        | 72.1  | 66.7  | 60.7  |

<sup>a</sup>Does not include slaughter calves. Internal inconsistencies and non-additivity result from separate projections for each class and total slaughter.

<sup>b</sup>All A grades are used for comparisons with Choice.

Total stockyard receipts of feeder cattle have displayed a significant upward trend of about 15.4 thousand head per year over the 1952-72 period. However, individual markets reflect trends that are somewhat different than the aggregate. Calgary, Lethbridge, Montreal and Winnipeg did not show a significant trend in feeder cattle sales for the period. There was no feeder cattle market to speak of at Montreal. Because of some very large year-to-year fluctuations in their marketings at Calgary, Lethbridge, and Winnipeg, particularly during the mid-fifties and the mid-sixties, poor trend estimates

were obtained for these series (that is, the  $R^2$  value was very low). The other five markets, Edmonton, Prince Albert, Regina, Saskatoon and Toronto, however, accounted for the upward trend in the feeder receipts. There was a very pronounced trend increase in the feeder cattle trade at Edmonton.

Table 4 shows the projected trends in stockyard receipts of feeder cattle for five markets. The uptrend in the feeder cattle market at Prince Albert was based on a trend estimate calculated by a different method (footnote 2, Table 4).

## SUMMARY AND CONCLUSIONS

Statistical identification and projection of the trends in public stockyard marketings suggest that slaughter cattle receipts will decline while feeder cattle receipts may increase over the next 20 years. Assuming a continuation of past trends and conditions, significant declines in slaughter cattle deliveries are projected for all but the Prince Albert, Regina and Toronto<sup>11</sup> public yards over the next two decades.

While feeder cattle marketings at some of the yards may help offset projected declines of the slaughter cattle volumes, the analysis suggests that most yards will be either operating at well below present capacity or may have to close because of lack of business during some days, weeks or seasons of the year. It should be reiterated, however, that the analysis assumes a continuation of operating procedures, producer attitudes, and other conditions that have determined recent trends. These need not remain static.

The trend projections indicate that, in aggregate, marketings via public stockyards will represent an increasingly smaller proportion of total slaughter cattle marketings. In some regions, for some periods of the year, the percentage may be an inadequate sample upon which to base reliable market information<sup>12</sup>. For example, projection of trends to 1990 indicate ratios of annual public stockyard marketings to total slaughter of less than 5 percent for many classes and markets. This has serious implications for the pricing efficiency of the entire market, considering the likely variance in this ratio

among individual days, months or seasons. It may necessitate revisions in the sources and collection of market information.

**TABLE 4. PROJECTED FEEDER CATTLE MARKETINGS AT PUBLIC STOCKYARDS, 1980 TO 1990<sup>a</sup>**

|                            | 1980              | Projections<br>1985 | 1990  |
|----------------------------|-------------------|---------------------|-------|
|                            | — thousand head — |                     |       |
| Edmonton                   | 224.2             | 259.9               | 295.7 |
| Prince Albert <sup>b</sup> | 59.2              | 75.8                | 94.6  |
| Regina                     | 47.2              | 55.0                | 62.7  |
| Saskatoon                  | 69.2              | 79.2                | 89.3  |
| Toronto                    | 104.0             | 113.5               | 123.0 |
| Nine Public Yards          | 677.2             | 754.2               | 831.2 |

<sup>a</sup>No significant trends from which to project marketings were found for the Calgary, Lethbridge, Winnipeg and Montreal markets.

<sup>b</sup>Derived from the product of projected marketing/slaughter ratios and projected provincial slaughter in an attempt to provide a better regression line fit.

## REFERENCES

1. Williams W.F., and T.T. Stout, *Economics of the Livestock-Meat Industry*, The MacMillan Company, N.Y., 1964.
2. Hawkins, M.H., "Alternative Methods of Marketing Livestock", *Canadian Journal of Agricultural Economics*, Vol. 17, No. 3. Nov. 1969, pp. 104-110.
3. Wood, A.W., "Implications of Developing Market Practices and Structures to the Canadian Beef Industry", C.J.A.E. Workshop Proceedings, 1970, pp. 165-173.
4. *Livestock Marketing in Manitoba*, Report of the Inquiry into Livestock Marketing by the Manitoba Livestock and Meat Commission, Jan. 26, 1976, pp.23-25.
5. *Restrictive Trade Practices Commission Report on the Meat Industry . . .* (Queen's Printer, 1961) p. 282.
6. *1973 Packers and Stockyards Administration Report*, U.S.D.A.
7. Williams, C.M., "The Canadian Beef Market System", *Stockman's Day Report*, University of Saskatchewan, 1975, page 72.

<sup>11</sup>Projections for Toronto differed significantly among classes of cattle and degree of aggregation of marketings.

<sup>12</sup>The statistical representativeness of these small samples was not considered here.

**APPENDIX TABLE 1. ANNUAL AVERAGE RECEIPTS OF STEERS, HEIFERS, COWS AND BULLS AT PUBLIC STOCKYARDS IN CANADA, 1953-62 AND 1963-72.**

| Market               | Average<br>1953-62 |         |       |       | Average<br>1963-72 |         |       |       | Change      |         |      |       |
|----------------------|--------------------|---------|-------|-------|--------------------|---------|-------|-------|-------------|---------|------|-------|
|                      | Steers             | Heifers | Cows  | Bulls | Steers             | Heifers | Cows  | Bulls | Steers      | Heifers | Cows | Bulls |
|                      | — thousand head —  |         |       |       |                    |         |       |       | — percent — |         |      |       |
| Calgary              | 101.8              | 45.9    | 42.5  | 4.6   | 100.1              | 54.7    | 38.3  | 4.5   | - 2         | +19     | -10  | - 2   |
| Edmonton             | 39.7               | 17.2    | 23.4  | 3.8   | 34.5               | 24.6    | 34.4  | 4.2   | -13         | +43     | +47  | +10   |
| Lethbridge           | 19.0               | 8.2     | 9.3   | 1.0   | 8.2                | 3.8     | 5.8   | 0.6   | -57         | -54     | -38  | -40   |
| Prince Albert        | 7.2                | 3.5     | 5.0   | 0.7   | 12.2               | 5.2     | 6.7   | 0.7   | +69         | +49     | +34  | -     |
| Regina               | 8.6                | 4.8     | 8.5   | 0.9   | 9.3                | 7.8     | 11.8  | 1.3   | + 8         | +62     | +39  | +44   |
| Saskatoon            | 27.3               | 14.7    | 14.9  | 2.3   | 23.8               | 14.5    | 16.6  | 2.1   | -13         | - 1     | +11  | - 9   |
| Winnipeg             | 70.1               | 31.3    | 62.9  | 7.8   | 73.7               | 31.1    | 59.4  | 7.0   | + 5         | -       | - 6  | -10   |
| Toronto              | 135.2              | 63.1    | 87.1  | 9.4   | 185.0              | 95.3    | 89.4  | 7.9   | +37         | +51     | + 3  | -16   |
| Montreal             | 22.0               | 6.8     | 60.7  | 11.0  | 9.1                | 4.0     | 66.8  | 8.2   | -59         | -41     | +10  | -26   |
| Nine Market<br>Total | 430.9              | 195.4   | 314.3 | 41.5  | 455.9              | 241.0   | 329.2 | 36.5  | + 6         | +23     | + 5  | -12   |

Source: "Livestock Market Review", Production and Marketing Branch, Agriculture Canada, annual.

**APPENDIX TABLE 2. PERCENTAGE OF STEERS, HEIFERS, COWS AND BULLS IN TOTAL SLAUGHTER CATTLE RECEIPTS AT PUBLIC STOCKYARDS IN CANADA, 1953-62 AND 1963-72**

| Market            | Average 1953-62 |         |      |       |       | Average 1963-72 |         |      |       |       |
|-------------------|-----------------|---------|------|-------|-------|-----------------|---------|------|-------|-------|
|                   | Steers          | Heifers | Cows | Bulls | Total | Steers          | Heifers | Cows | Bulls | Total |
| Calgary           | 52.7            | 23.2    | 21.8 | 2.3   | 100.0 | 50.8            | 27.5    | 19.4 | 2.3   | 100.0 |
| Edmonton          | 47.3            | 20.4    | 27.7 | 4.6   | 100.0 | 35.5            | 24.7    | 35.3 | 4.5   | 100.0 |
| Lethbridge        | 50.8            | 21.2    | 25.1 | 2.9   | 100.0 | 43.9            | 21.2    | 31.2 | 3.7   | 100.0 |
| Prince Albert     | 44.3            | 21.0    | 30.3 | 4.4   | 100.0 | 48.8            | 20.9    | 27.3 | 3.0   | 100.0 |
| Regina            | 38.2            | 20.9    | 36.9 | 4.0   | 100.0 | 31.6            | 25.9    | 38.5 | 4.0   | 100.0 |
| Saskatoon         | 46.4            | 24.6    | 25.1 | 3.9   | 100.0 | 42.4            | 25.4    | 28.5 | 3.7   | 100.0 |
| Winnipeg          | 40.7            | 18.2    | 36.5 | 4.6   | 100.0 | 44.2            | 17.8    | 33.8 | 4.2   | 100.0 |
| Toronto           | 45.9            | 21.4    | 29.5 | 3.2   | 100.0 | 49.1            | 25.2    | 23.5 | 2.2   | 100.0 |
| Montreal          | 21.9            | 6.7     | 60.4 | 11.0  | 100.0 | 10.2            | 4.5     | 76.0 | 9.3   | 100.0 |
| Nine Market Total | 44.1            | 19.8    | 31.1 | 4.2   | 100.0 | 43.3            | 22.6    | 30.7 | 3.4   | 100.0 |

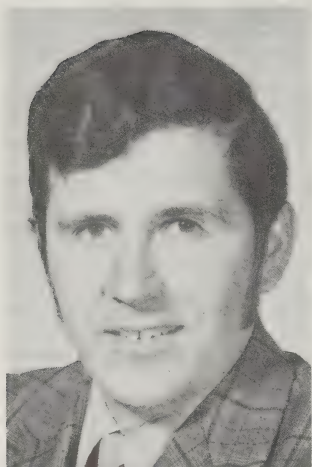
Source: "Livestock Market Review", Production and Marketing Branch, Agriculture Canada, annual.

APPENDIX TABLE 3. AVERAGE NUMBER OF SLAUGHTER STEERS AND HEIFERS MARKETED AT PUBLIC STOCKYARDS BY GRADE, 1953-62 AND 1963-72.

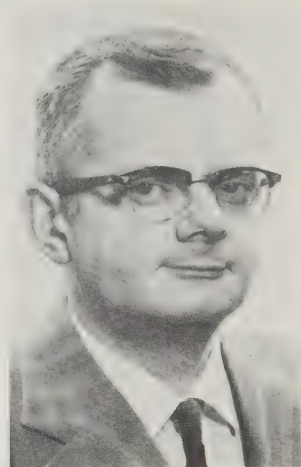
| Class and Grade | Calgary         |                 |        | Edmonton        |                 |        | Lethbridge      |                 |        | Prince Albert   |                 |        | Regina            |                 |        |
|-----------------|-----------------|-----------------|--------|-----------------|-----------------|--------|-----------------|-----------------|--------|-----------------|-----------------|--------|-------------------|-----------------|--------|
|                 | Average 1953-62 | Average 1963-72 | Change | Average 1953-62 | Average 1963-72 | Change | Average 1953-62 | Average 1963-72 | Change | Average 1953-62 | Average 1963-72 | Change | Average 1953-62   | Average 1963-72 | Change |
|                 | '000 head —     | %               | %      | '000 head —     | %               | %      | '000 head —     | %               | %      | '000 head —     | %               | %      | '000 head —       | %               | %      |
| Choice          | 45.3            | 60.5            | +34    | 13.1            | 19.0            | +45    | 10.2            | 4.9             | -52    | 1.5             | 7.6             | +407   | 2.1               | 5.3             | +152   |
| Steers          | 16.6            | 26.1            | +57    | 2.6             | 9.2             | +254   | 3.3             | 2.4             | -27    | —               | 1.2             | (+)    | .3                | 2.0             | (+)    |
| Heifers         |                 |                 |        |                 |                 |        |                 |                 |        |                 |                 |        |                   |                 |        |
| Good            | 33.4            | 24.8            | -26    | 11.2            | 8.4             | -25    | 5.5             | 1.8             | -67    | 2.0             | 3.0             | +50    | 2.4               | 2.9             | +21    |
| Steers          | 13.5            | 16.4            | +21    | 3.3             | 6.3             | +91    | 2.6             | .9              | -65    | .5              | 1.9             | +280   | .9                | 3.4             | +278   |
| Heifers         |                 |                 |        |                 |                 |        |                 |                 |        |                 |                 |        |                   |                 |        |
| Medium          | 17.4            | 10.3            | -41    | 9.6             | 5.2             | -46    | 2.4             | 1.3             | -46    | 2.4             | 1.3             | -46    | 2.8               | 1.0             | -64    |
| Steers          | 10.0            | 8.1             | -19    | 6.4             | 5.3             | -17    | 1.6             | —               | (-)    | 1.5             | 1.5             | NC     | 2.3               | 2.2             | -4     |
| Heifers         |                 |                 |        |                 |                 |        |                 |                 |        |                 |                 |        |                   |                 |        |
| Common          | 5.7             | 4.6             | -19    | 5.8             | 1.9             | -67    | .7              | —               | (-)    | 1.4             | —               | (-)    | 1.4               | —               | (-)    |
| Steers          | 5.8             | 4.1             | -29    | 4.9             | 3.9             | -20    | .6              | —               | (-)    | 1.4             | —               | (-)    | 1.3               | —               | (-)    |
| Heifers         |                 |                 |        |                 |                 |        |                 |                 |        |                 |                 |        |                   |                 |        |
|                 |                 |                 |        |                 |                 |        |                 |                 |        |                 |                 |        |                   |                 |        |
| Class and Grade | Saskatoon       |                 |        | Winnipeg        |                 |        | Toronto         |                 |        | Montreal        |                 |        | Nine Market Total |                 |        |
|                 | Average 1953-62 | Average 1963-72 | Change | Average 1953-62 | Average 1963-72 | Change | Average 1953-62 | Average 1963-72 | Change | Average 1953-62 | Average 1963-72 | Change | Average 1953-62   | Average 1963-72 | Change |
|                 | '000 head —     | %               | %      | '000 head —     | %               | %      | '000 head —     | %               | %      | '000 head —     | %               | %      | '000 head —       | %               | %      |
| Choice          | 7.9             | 12.5            | +58    | 15.3            | 29.4            | +92    | 42.9            | 90.1            | +110   | 2.9             | 1.1             | -62    | 141.2             | 230.4           | +63    |
| Steers          | 1.9             | 3.9             | +105   | 4.0             | 7.3             | +82    | 1.9             | 33.1            | (+)    | —               | —               | N.A.   | 30.6              | 85.2            | +178   |
| Heifers         |                 |                 |        |                 |                 |        |                 |                 |        |                 |                 |        |                   |                 |        |
| Good            | 8.5             | 6.2             | -27    | 23.3            | 20.9            | -10    | 45.9            | 46.5            | +1     | 5.2             | 1.8             | -65    | 137.4             | 116.3           | -15    |
| Steers          | 3.1             | 4.1             | +32    | 7.8             | 7.6             | -3     | 21.5            | 26.5            | +23    | .3              | .5              | +67    | 53.5              | 67.6            | +26    |
| Heifers         |                 |                 |        |                 |                 |        |                 |                 |        |                 |                 |        |                   |                 |        |
| Medium          | 7.8             | 4.1             | -47    | 23.7            | 18.5            | -22    | 33.6            | 32.3            | -4     | 8.9             | 2.8             | -69    | 108.6             | 76.8            | -29    |
| Steers          | 5.2             | 4.5             | -14    | 11.9            | 11.7            | -2     | 26.2            | 24.1            | -8     | 2.0             | .9              | -55    | 67.1              | 58.3            | -13    |
| Heifers         |                 |                 |        |                 |                 |        |                 |                 |        |                 |                 |        |                   |                 |        |
| Common          | 3.2             | 1.0             | -69    | 7.8             | 4.9             | -37    | 12.8            | 16.0            | +25    | 4.9             | 3.4             | -31    | 43.7              | 32.3            | -26    |
| Steers          | 4.5             | 2.1             | -53    | 7.6             | 4.5             | -41    | 13.5            | 11.6            | -14    | 4.4             | 2.4             | -46    | 44.0              | 29.8            | -32    |
| Heifers         |                 |                 |        |                 |                 |        |                 |                 |        |                 |                 |        |                   |                 |        |

Source: "Livestock Market Review", Production and Marketing Branch, Agriculture Canada, annual.

# CALCULATING LEAST-COST IMPLEMENT SIZES FOR TILLAGE AND SEEDING OF CEREALS



*The least-cost implement sizes for tillage and seeding of cereal grains can be found by calculating the costs for all tractor-implement combinations and choosing the combination that has the lowest cost associated with it.*



J.A. McIsaac and James Lovering\*

## INTRODUCTION

Owning and operating farm machinery make up a significant proportion of total farm costs. There is relatively little information available on which to base sound decisions respecting least-cost implement sizes. The selection of least-cost implement sizes is a complex problem involving cultural practices, weather, implement prices, crop acreages, labor costs, crop value, yield losses due to delayed operations, and other factors. A systematic means of solving this problem that can be readily used by extension or research workers and farmers would be useful.

This paper describes a computer program (written in Fortran IV and available from the authors on request) that calculates the sizes of implements and tractors for least-cost cereal tillage and seeding operations for situations in which specific implement operations are assigned either to one or two tractors. The specific implement types needed are determined by the program user.

## PROGRAM DESCRIPTION

The least-cost implement sizes are found by calculating and comparing the costs for each possible combination of implement sizes (Figure 1). The number of combinations is determined by specifying: (1) The implements to be considered; (2) their minimum and maximum sizes; and (3) the increment used to distinguish one implement size from another.

Power requirements, measured in power-take-off horsepower, are calculated from the draft requirements for each type and size of implement. The size of tractor used for each combination of implements is that needed to pull the implement with the greatest draft requirement. Alternatively, the maximum size of each tractor to be considered can be specified by the program user. Then only the implements that can be pulled by the tractor(s) specified would be considered.

If two tractors are to be used for the tillage and seeding operations, the program compares the costs of all implement size combinations for all combinations of tractors and implements (Table 1).

The program uses implement work rates and work-day probabilities to determine the acreage seeded before

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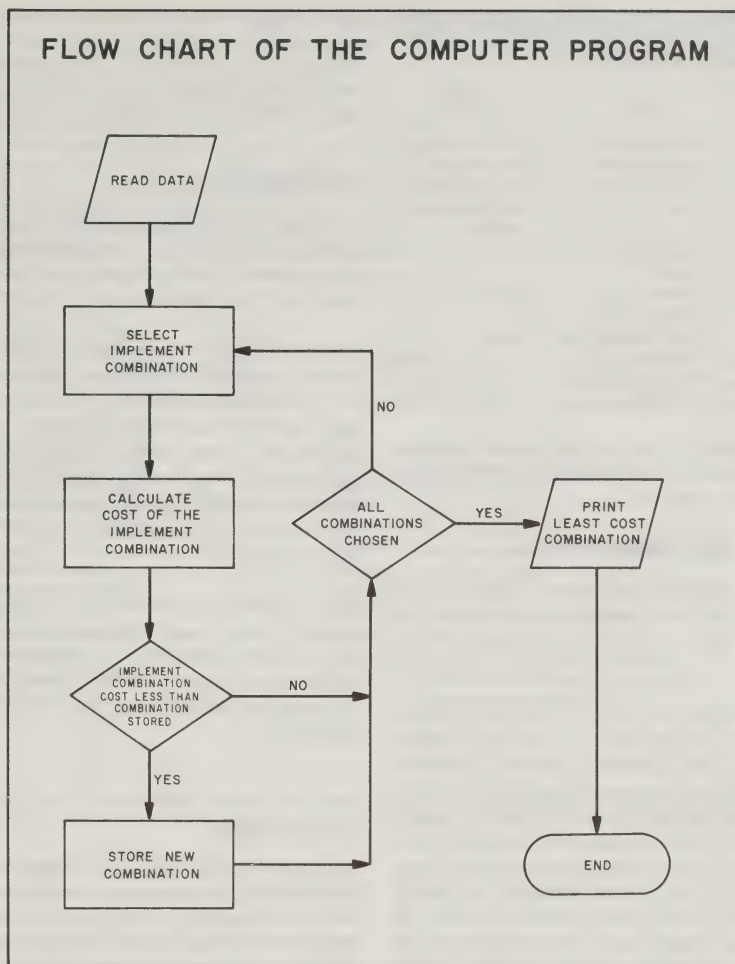


Figure 1

yield loss begins. Then, work-day probabilities, implement work rates, and crop-loss rates are used to calculate penalty costs on the acreage remaining to be seeded.

The calculated costs comprise fixed and variable costs for each implement and tractor, labor costs, and the value of crop losses due to late seeding (penalty cost).

### COST CALCULATIONS

Annual tractor and implement costs are calculated as the sum of annual depreciation, interest, insurance and shelter, repair costs, and fuel and lubrication costs.

Labor costs are calculated for the time spent performing the field operations. The labor of a second man is included for the seeding operation.

The penalty cost is calculated by multiplying the crop-loss rate by the hours and acres the loss applies to and dividing by two times the work-day probability. Dividing by two gives the average crop loss since the crop loss is spread throughout much of the seeding period.

The total cost is the sum of tractor, implement, labor, and penalty costs.

**TABLE 1. POSSIBLE TRACTOR-IMPLEMENT COMBINATIONS WHEN CONSIDERING TWO TRACTORS AND ONE OF EACH IMPLEMENT**

| Combination No. | Tractor 1                 | Tractor 2               |
|-----------------|---------------------------|-------------------------|
| 1               | Plow and disc             | Harrow and seeder       |
| 2               | Plow and harrow           | Disc and seeder         |
| 3               | Disc and harrow           | Plow and seeder         |
| 4               | Plow                      | Disc, harrow and seeder |
| 5               | Plow, harrow and seeder   | Disc                    |
| 6               | Plow, disc and seeder     | Harrow                  |
| 7               | Plow, disc and harrow     | Seeder                  |
| 8               | The one-tractor situation |                         |

The equations used for the cost calculations are shown in the documentation of the program, which is available from the authors on request.

## PROGRAM INPUT AND OUTPUT

The program was written for use on interactive computer terminals and uses data supplied (1) from an existing file (cards, tape, disc, or drum) and (2) interactively.

The data contained on the existing file include machinery prices, years and hours of life, draft requirement, repair rate, and implement efficiency. These data can be changed between program runs but not during a run. The interactive data, however, can be changed during a run. Only the data required for the specification of a particular situation are entered interactively. These data (underlined in Table 2) are: acreages to be plowed, disced, harrowed and seeded in the fall and spring, the number of times discing and harrowing are to be performed, the minimum, maximum and increment sizes to be considered for implements, and the proportion of tractor fixed costs to be charged to cereal seeding. The program user can specify maximum tractor sizes to be considered or let the program choose them. He can also specify which of the following he wants first: (1) the least-cost implement sizes for all combinations of tractors and machines, or (2) the 20 lowest-cost implement sizes for one or more particular combinations of tractors and implements. The common procedure would likely be to determine the least-cost implement sizes for all combinations of tractors and implements (Table 3) and then determine the 20 lowest-cost implement sizes for the least-cost combination of tractors and implements to evaluate the sensitivity of the cereal tillage and planting costs to changes in implement sizes.

The output (Table 3) shows required tractor horsepower, least-cost implement sizes, hours of tractor use, and hours of use for plow (spring and fall separately), disc, harrows and seeder, labor costs, tractor costs, costs of other implements, penalty cost and total cost.

## AN EXAMPLE

The input in Table 2 represents a situation in which 200 acres are to be seeded; half the plowing is to be done in the fall while all the discing (once over), harrowing (twice over), and seeding are to be done in the spring.

Implement sizes to be considered are: plow—one to eight furrows (16 inch) in increments of one furrow; disc — 8 to 24 feet in increments of 2 feet; harrow — 10 to 30 feet in increments of 2 feet; and seeder — 6 to 24 feet in increments of 2 feet. Half the tractor fixed costs are to be charged to cereal seeding. These sizes, together with eight possible allocations of implements to both one and two tractors, represent a total of 63,360 combinations to be examined.

Table 3 shows that combination 2 (plow and harrows pulled by tractor 1 and disc and seeder by tractor 2) is the least costly allocation of implements of two tractors; and that four furrows, 8 feet, 14 feet, and 10 feet are the least-cost sizes for plow, disc, harrow, and seeder, respectively.

## LIMITATIONS

The program uses long-term (30 years) mean work-day probabilities to determine the working time available in the relevant period in the spring. These are used to calculate the acreage that can be seeded before crop loss begins and the extent of crop loss that occurs on the acreage remaining to be seeded. The assumption of a constant work-day probability throughout the entire seeding period may bias the estimation of least-cost implement-size combinations. The difference, if any, in least-cost implement-size combinations calculated by this program and those that would be calculated by a program using daily weather for each year individually has not yet been determined.

Implement and tractor purchase prices are calculated as the product of size (feet of width or power-take-off horsepower) and cost per unit, implying that purchase prices are linear with size. While this relationship is not precisely correct, it is an approximation that results in small errors that tend to cancel out when several kinds of implements are considered together.

**TABLE 2. QUESTIONS ASKED BY THE PROGRAM AND INPUT (UNDERLINED> BY PROGRAM USER**

Cultural Practice No. ... 1  
 Total acres plowed and acres spring plowed (2F5,0 format) ... 200 100  
 Plow sizes (min. and max.) and increments (314 format) ... 1 8 1  
 Total acres disced, acres disced in spring and no. cuts ... 200 200 1  
 Disc sizes (min. and max.) and increments (314 format) ... 8 24 2  
 Harrow acreages and cuts (3F5,0 format) ... 200 200 2  
 Harrow sizes (min. and max.) and increments (314 format) ... 10 30 2  
 Total acres seeded and acres seeded in spring (2F5,0 format) ... 200 200  
 Seeder sizes (min. and max.) and increments (314 format) ... 6 24 2  
 Proportion of tractor fixed costs charged to cereal seeding (F4,2 format) ... .5  
 Do you want to enter maximum tractor sizes? Type 1 for yes, 0 for no ... 0

**DATA LISTBACK**

|           |            |           |            |            |             |
|-----------|------------|-----------|------------|------------|-------------|
| PAC — 200 | PSAC — 100 | LPBTM — 1 | MPBTM — 8  | IPBTM — 1  |             |
| DAC — 200 | DSAC — 200 | DCUTS — 1 | LDWID — 8  | MDWID — 24 | IDWID — 2   |
| HAC — 200 | HSAC — 200 | HCUTS — 2 | IHWID — 10 | MHWID — 30 | IHWID — 2   |
| SAC — 200 | SSAC — 200 | LSWID — 6 | MSWID — 24 | ISWID — 2  | TPROP — .50 |

**DESCRIPTION OF VARIABLES**

|   |  |
|---|--|
| PAC — total acres plowed per year           | MPBTM — max. plow size (no. 16-in. furrows)                        |
| DAC — total acres disced per year           | LDWID — min. disc size (ft)  |
| HAC — total acres harrowed per year         | LHWID — min. harrow size (ft)                                      |
| SAC — total acres seeded per year           | MSWID — max. seeder size (ft)                                      |
| PSAC — acres plowed in spring               | IPBTM — amt. plow size incremented (16-in. furrows)                |
| DSAC — acres disced in spring               | MDWID — max. disc size (ft)  |
| HSAC — acres harrowed in spring             | MHWID — max. harrow size (ft)                                      |
| SSAC — acres seeded in spring               | ISWID — amt. seeder size incremented (ft)                          |
| LPBTM — min. plow size (no. 16-in. furrows) | IDWID — amt. disc size incremented (ft)                            |
| DCUTS — times over for disc                 | IHWID — amt. harrow size incremented (ft)                          |
| HCUTS — times over for harrow               | TPROP — proportion of tractor costs charged to tillage and seeding |
| LSWID — min. seeder size (ft)               |  |

**TABLE 3. LEAST-COST IMPLEMENT SIZES FOR EACH TRACTOR-IMPLEMENT COMBINATION**

| Item and Unit                                | Tractor-Implement Combination |          |          |          |          |          |          |                |
|--|-------------------------------|----------|----------|----------|----------|----------|----------|----------------|
|  | 1                             | 2        | 3        | 4        | 5        | 6        | 7        | 8 <sup>a</sup> |
| Horsepower of tractor no. 1                  | 42.00                         | 53.33    | 40.60    | 26.67    | 68.40    | 53.33    | 68.40    | 83.60          |
| Total time tractor no. 1 tillage and seeding | 96.58                         | 97.53    | 87.30    | 85.94    | 98.81    | 100.15   | 101.37   | 105.19         |
| Horsepower of tractor no. 2                  | 45.60                         | 33.60    | 53.20    | 60.80    | 33.60    | 38.00    | 17.40    | 0.00           |
| Total time tractor no. 2 tillage and seeding | 95.09                         | 93.11    | 88.72    | 97.80    | 49.11    | 76.39    | 73.33    | 0.00           |
| Plow size (no. of 16-in. furrows)            | 3                             | 4        | 3        | 2        | 5        | 4        | 5        | 6              |
| Disc size (width in ft)                      | 10                            | 8        | 12       | 14       | 8        | 12       | 16       | 18             |
| Harrow size (width in ft)                    | 12                            | 14       | 14       | 16       | 18       | 10       | 18       | 22             |
| Seeder size (width in ft)                    | 14                            | 10       | 14       | 20       | 20       | 18       | 6        | 22             |
| Time spent plowing in spring (hours)         | 57.29                         | 42.97    | 57.29    | 85.94    | 34.38    | 42.97    | 34.38    | 28.65          |
| Total time spent plowing (hours per year)    | 114.58                        | 85.94    | 114.58   | 171.88   | 68.75    | 85.94    | 68.75    | 57.29          |
| Time spent discing (hours per year)          | 39.29                         | 49.11    | 32.74    | 28.06    | 49.11    | 32.74    | 24.55    | 21.83          |
| Time spent harrowing (hours per year)        | 63.66                         | 54.56    | 54.56    | 47.74    | 42.44    | 76.39    | 42.44    | 34.72          |
| Total time spent seeding (hours per year)    | 31.43                         | 44.00    | 31.43    | 22.00    | 22.00    | 24.44    | 73.33    | 20.00          |
| Labor costs (dollars per hour)               | 841.15                        | 832.82   | 794.23   | 875.04   | 612.89   | 731.86   | 847.23   | 461.52         |
| Total tractor costs (dollars)                | 1,891.08                      | 1,874.19 | 2,018.31 | 1,881.54 | 2,154.07 | 1,952.59 | 1,851.80 | 1,828.06       |
| Total implement costs (dollars)              | 1,320.35                      | 1,218.49 | 1,414.31 | 1,628.30 | 1,729.70 | 1,631.22 | 1,514.58 | 2,324.27       |
| Total penalty costs (dollars per year)       | 289.25                        | 312.33   | 127.31   | 319.03   | 344.33   | 378.98   | 411.50   | 519.98         |
| Total costs (dollars per year)               | 4,341.83                      | 4,237.83 | 4,354.15 | 4,703.91 | 4,840.98 | 4,694.64 | 4,625.11 | 5,133.82       |

<sup>a</sup>The one-tractor combination

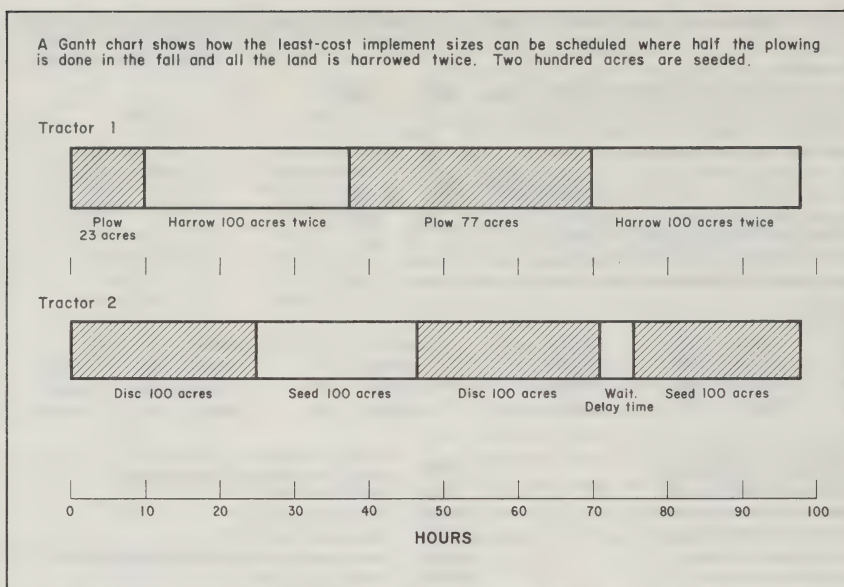


Figure 2

Although this program does calculate least-cost implement size combinations, it does not consider the scheduling of operations for two tractors to which up to four implements are allocated in various combinations. It may be difficult to schedule some of the tractor-implement least-cost size combinations if the operator is unwilling or unable to make frequent switches among implements. If, however, switches between the implements allocated to a particular tractor can be made frequently (e.g., each half day), it is possible to schedule the operations to complete the seeding in the times indicated with the implement sizes calculated by this program. Figure 2 is a Gantt chart showing scheduling for combination 2 (plow and harrow pulled by tractor 1, disc and seeder pulled by tractor 2) described in Tables 2 and 3.

When this program is used to determine least-cost implement size combinations without the specification of maximum tractor sizes, there is obviously no guarantee that the tractor sizes chosen will be consistent with other farm needs such as forage harvesting. Results should, therefore, be checked for consistency with other tractor uses.

## APPLICATIONS

This program is being used as a decision aid in determining optimum implement combinations for cereal tillage and seeding in the Maritimes for a wide

range of farm situations. The intent is to provide the basis for recommendations by extension personnel.

It has been used to plan investment decisions and estimate costs for custom operators and to estimate implement costs in cost-of-production studies.

It is expected that the program will be useful in evaluating future experiments designed to examine alternative tillage and seeding methods.

The discussion here has been on implement sizes for cereal tillage and seeding operations. The principles apply to other farm implement size selection problems concerning combinations of implements. The crop-loss function and other factors would vary for different crops and areas. With a few changes, the program could be adapted to tillage and seeding operations of other crops and other areas.

This program can be used to find least-cost implement sizes for tillage and seeding operations for cereals using different implements than are used in this paper. The purchase prices, drawbar power requirements, and other information pertaining to the implements would have to be used in place of the data used in the example in this paper.

The draft requirement or other data for the implements can be changed to represent the soil type, machinery prices, etc. of any area.

# LEGISLATION

## AGRICULTURAL STABILIZATION ACT

### Production Cost Index Regulations (March 1976)

These regulations to the Act were recommended by the Agricultural Stabilization Board to provide an indexing formula for establishing the prescribed price of a commodity. The formula applies to commodities named in the Act, and to any others that may be designated by the Governor in Council.

To determine the prescribed price of the named commodities for a year, the base price (being the average of the five years immediately preceding the year) is adjusted by the percentage named in the Act, i.e., 90 percent (or such higher percentage as the Governor in Council may determine) plus an index based on costs of production in that year as compared with the average of the preceding five years. In the case of designated commodities, the percentage of the base price must also be determined by the Governor in Council.

Costs of production included are all cash expenses associated with the production of the commodity. For livestock enterprises this includes such things as feed, veterinary services, utilities, hired labor, repairs, maintenance, insurance, property taxes and interest on the portion of operating capital that is borrowed.

For crop enterprises, costs include such things as seed and seed treatment, fertilizer, herbicides and pesticides, machinery operating costs, crop insurance, property taxes and interest on borrowed operating capital.

## AGRICULTURAL PRODUCTS COOPERATIVE MARKETING ACT

### Interim Wheat Payments (March 1976)

This legislation authorized the Ontario Wheat Producers' Marketing Board to make an interim payment to producers of 85 cents a bushel for Number 2 Canada Eastern Wheat at 14 percent moisture for the marketing of wheat produced in Ontario in 1975.

## GRAIN FUTURES ACT

### Extension of Provisions (March 1976)

By this legislation the provisions of the Act were extended, on the recommendation of the Canadian Grain Commission, to include five grain exchanges and

associations, two of which have been newly named since the Act was passed in 1939. The two newly-named bodies are the Winnipeg Commodity Exchange (formerly Winnipeg Grain Exchange) and Winnipeg Commodity Clearing Ltd. (formerly Winnipeg Grain and Produce Exchange Clearing Association Ltd.). The other three are the Vancouver Grain Exchange, the Lake Shippers' Clearance Association and the British Columbia Grain Shippers' Clearance Association.

## FINANCIAL ADMINISTRATION ACT

### Administered by Department of Finance

### Remission of import duties on fruits and vegetables (March 1976)

The Fruits and Vegetables Remission Order, printed in the Canada Gazette of April 14, granted remission of customs duties paid by Canadian companies on fruits and vegetables imported for processing during 1973 and 1974. Schedules A and B of the Order prescribed the maximum number of pounds of each item that were eligible for the remission. The Order applied to fresh sweet cherries, pears, strawberries, broccoli, cauliflower, cucumbers, asparagus, beets, beans and pickled silverskin onions. The Order as printed in the Gazette lists the food processing companies to which the remission applied.

## SEEDS ACT

### Amendments to Seed Regulations (April 1976)

These amendments were introduced in response to a growing demand for pedigreed cereal mixtures. They provide for a new seed grade: Canada Certified (Cereal) Mixture. With the introduction of this new grade, the use of variety names for Canada No. 1 or No. 2 cereal mixtures is no longer permitted. To facilitate handling of the growing crop, certified cereal mixtures are required to contain only those crop kinds which, when mixed, remain homogeneous and which are compatible in terms of maturity, method of planting and method of harvesting.

The amendments introduce changes in the Regulations designed to strengthen them whenever enforcement measures are necessary. A revision in the schedule changes the definition of "variety". It now has the meaning assigned to cultivar by the International Association of Biological Sciences' Commission on the Nomenclature of Cultivated Plants.

# PROGRAMS AND POLICIES

## DAIRY POLICY

The announcement of a new federal dairy policy was made by Agriculture Minister Eugene Whelan in the House of Commons on April 13. The main points of the announcement are the following:

- For industrial milk the target returns level has been raised from the previous level of \$11.02 to \$11.45 per hundredweight (3.5 percent butterfat).
- The direct federal subsidy on industrial milk and cream paid to producers will be \$2.66 per hundred pounds of milk, unchanged from last year. This means, the Minister said, that the increase in prices of dairy products would be held to a minimum. The maximum volume eligible for the subsidy is 95 million hundredweights. Payment to each producer during the year will be made on up to 94.5 percent of his deliveries within market share quota. A final adjustment will be made at the end of the year.
- To reach this year's target returns, the support price of butter is increased by five cents to \$1.08 a pound, and the support price for skim milk powder is increased by four cents to 68 cents a pound.
- The quota on imported cheese remains unchanged at 50 million pounds a year.
- Producers are requested to cut back sharply from the 111 million hundredweights they shipped last year. The total Market Share Quota has been set at 100.5 million hundredweights, which provincial marketing boards will allocate among producers. This should result in actual production of 95 million hundredweights. Producers will pay a special levy of \$8.60 a hundredweight for production over their share of the 95 million. The federal government is contributing \$24 million toward marketing costs, an increase of \$15 million from the amount provided in last year's budget. The remaining marketing costs will be financed through the 1976-77 producer levy, applicable to all shipments within the Market Share Quota, of \$1.35 per hundredweight.
- The Canadian International Development Agency has been asked to investigate the possibility of increasing the amount of skim milk powder in its food aid program.

## Wheat Board Supports New West Coast Terminals

The Canadian Wheat Board announced on April 12 that it was offering grain companies an incentive program to encourage construction of as much as 14 million bushels of additional terminal capacity at West Coast ports. Companies using the program will be guaranteed storage payments on 90 to 100 percent of their total licensed capacity. At least 10 percent of their new licensed capacity must be reserved for non-board grains. Payments will start when the new facilities are operational and will continue until July 31, 1985. The deadline for response to the offer was May 31, 1976. The Chief Commissioner of the Wheat Board, G.N. Vogel, explained that the need for additional terminal facilities on the West Coast has been evident for a long time, and this incentive program is one way in which western grain farmers can help develop their own industry. "Although the incentives offered are tied to terminal storage capacity, the objective is to increase the dependability and throughput capacity of the West Coast facilities as quickly as possible," Mr. Vogel said. Canada must increase its capacity on the West Coast in order, among other reasons, to meet the increased demand for grain imports by Asian countries.

## Industry Group Set Up to Study Grain Shipping

On April 2 the Grain Transportation Committee in Winnipeg announced the establishment of a new technical group to examine operation procedures in the grain handling and transportation system and to evaluate proposals for future development of the industry.

The committee, which consists of representatives from the Canadian Wheat Board, the Canadian Grain Commission, elevator companies, the two major railways and the Lake Shippers Clearance Association, has a dual role: to review the operations of the Block Shipping System (which it set up six years ago) and to examine recommendations now before the industry regarding allocation of rail cars.

## Farm Credit Corporation Budget

The capital budget of the Farm Credit Corporation (FCC) for the next fiscal year was authorized by Order in Council 1976-724, dated March 30. Early in April the Minister of Agriculture, Mr. Whelan, announced that the FCC had \$370 million left to lend farmers in 1976-77. An unusually heavy demand for loans last year resulted

in a reduced budget this year. By April 1 about \$190 million of the 1976-77 budget was already committed. Because of this limitation, Mr. Whelan stated, the FCC's first priority would be to assist competent farmers to acquire, develop and maintain viable family farms. "Those farmers who are now operating a viable farm and can provide a good living for their families will be asked to delay their loan applications or to borrow from other sources," he said. The FCC's interest rates were increased from 9 to 9 3/4 percent, effective April 1, 1976.

## Markets Information

The Canadian Agricultural Markets Information System (CAMIS) offers an improved flow of markets information to farmers, processors, wholesalers and retailers. It co-ordinates information being produced by various agencies, covering five areas: dairy, grains and special

crops, horticulture, poultry and livestock. Anyone wanting to identify markets information currently available can use the service. Organizations and individuals are invited to express their needs for information by writing to: Bob Bellingham, Camis Project, Room 624, Carling Building, Ottawa, K1A 0C5.

## Assistance for Producer Groups

On April 2 Agriculture Canada announced that agreements for financial assistance had been signed with four more producer groups under the Fresh Fruit and Vegetable Storage Construction Financial Assistance Program. This brought to 22 the number of projects assisted in the preceding 15 months. Under the program money is supplied by the federal government to cover one third of the cost of construction or renovation of storage facilities.

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# PUBLICATIONS

*Readers: when ordering publications, please write to the source indicated under the appropriate section.*

## ECONOMICS BRANCH

*Available from the Publications Manager, Room 303, Sir John Carling Building, Ottawa, K1A 0C5.*

**Family Expenditure Patterns in Canada: A statistical analysis of structural homogeneity.** Z.A. Hassan, S.R. Johnson. June 1976. Research report for economists and policy-makers indicating how expenditure on 14 commodity groups of goods and services varies with levels of family income and across various socio-economic characteristics. Publ. No. 76/3.

## AGRICULTURE CANADA

*Available from the Information Division, Agriculture Canada, Ottawa, K1A 0C7.*

**List of publications, 1976.** 16 pp. paper cover, Cat. No. A21-2/1976.

**New Crop Development Fund, 1976.** 17 pp., Bilingual, paper cover, Cat. No. A53-1580/1976.

## SUPPLY AND SERVICES CANADA

*Order from Supply and Services Canada, Printing and Publishing, Publications Centre, Mail Order Services, Ottawa K1A 0S9, or from Canadian Government Bookstores (formerly Information Canada) in Halifax, Montreal, Ottawa, Toronto, Winnipeg and Vancouver.*

**Agricultural Products Co-operative Marketing Act.** Amendment, December 1975. 1p, 25¢ in Canada, 30¢ in other countries. For content see CFE for April, Cat. No. YX3-301/85.

**Anti-Inflation Act.** December 1975. 34 pp., 25¢ a copy in Canada, 30¢ in other countries. Cat. No. YX3-301/75.

**Regional Development Incentives Act.** Amendment, December 1975. 2pp. 25¢ in Canada, 30¢ in other countries. For contents see CFE for April. Cat. No. YX3-301/84.

## OTHER PUBLICATIONS

**Commodity Futures Markets – Hedging Opportunities for Ontario Pork Producers.** Martin, Groenewegen, Meilke. U. of Guelph, January 1976. 42 pp., paper cover, Cat. No. AEEE/75/12.

*Write to the School of Agricultural Economics and Extension Education, OAC, University of Guelph, Guelph, Ontario N1G 2W1.*

**The Tax Structure and Canadian Trade.** J.R. Melvin. Economic Council of Canada, April 1976. 172 pp., \$4.00 in Canada, \$4.80 in other countries. Cat. No. EC22-37/1975.

*Obtainable from Supply and Services Canada, Printing and Publishing, Publications Centre, Mail Order Services, Ottawa, K1A 0S9.*

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## DEFINITIONS

*The following definitions are provided to help readers better understand the articles in this issue:*

### Article No. 1

**Capital Budgeting** — a systematic procedure for choosing among competing investment alternatives in a business. This procedure involves: (1) identifying investment alternatives; (2) estimating their costs and returns; (3) selecting a criterion for ranking and (4) analysis of the data.

**Cost of Capital** — the discount or capitalization rate used in capital budgeting. It is the minimum standard which an investment alternative must meet. In many cases, it is the rate of return that capital would earn when invested in the best alternative use.

### Article No. 2

**Market Performance** — the composite of end results of economic activity, measured by two interrelated components: pricing and operational (physical) efficiency; in part a function of the level of activity (volume of

product and number of participants) in the market.

**Operational efficiency** is measured by the productivity of resources utilized in the physical marketing function.

**Pricing efficiency** is a measure of the effectiveness with which price performs its functions of resource, product and income allocation, and in equating the forces of supply and demand.

### Article No. 3

**Work-day Probability** — the probability (expressed as a decimal) of a work-day occurring during a specific period. A work-day is one during which soil moisture and climatic factors allow field operations to be performed.

**Crop Loss Rate** — the rate at which the expected crop yield decreases because of untimely operations.

**Penalty Costs** — result from crop yield reduction due to untimely operations and represent the value of the crop yield that is lost.

## CORRECTION

### Volume 11, Number 2, April 1976

Page 8, Table 5. Under the heading Without wage and price controls, 1980, the figure 1559.6 for beef should read 2559.6, and the figure 159.0 for pork should read 1589.7. Under the same heading, 1985, the figure 174.9 for pork should read 1748.7.

**IN REPLY TO AUTHORS AND EDITORS REGARDING JUNE 1976**  
**CANADIAN FARM ECONOMICS**

I have read one or more of the following articles:

- (1) A Capital Budgeting Model for Evaluating Farm Real Estate Purchases
- (2) Trends in Cattle and Calf Marketings at Public Stockyards
- (3) Calculating Least-Cost Implement Sizes for Tillage and Seeding of Cereals

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# CONVERSION FACTORS FOR METRIC SYSTEM

| Imperial units         | Approximate<br>conversion factor   | Results in:                          |
|------------------------|------------------------------------|--------------------------------------|
| <b>LINEAR</b>          |                                    |                                      |
| inch                   | x 25                               | millimetre (mm)                      |
| foot                   | x 30                               | centimetre (cm)                      |
| yard                   | x 0.9                              | metre (m)                            |
| mile                   | x 1.6                              | kilometre (km)                       |
| <b>AREA</b>            |                                    |                                      |
| square inch            | x 6.5                              | square centimetre (cm <sup>2</sup> ) |
| square foot            | x 0.09                             | square metre (m <sup>2</sup> )       |
| acre                   | x 0.40                             | hectare (ha)                         |
| <b>VOLUME</b>          |                                    |                                      |
| cubic inch             | x 16                               | cubic centimetre (cm <sup>3</sup> )  |
| cubic foot             | x 28                               | cubic decimetre (dm <sup>3</sup> )   |
| cubic yard             | x 0.8                              | cubic metre (m <sup>3</sup> )        |
| fluid ounce            | x 28                               | millilitre (ml)                      |
| pint                   | x 0.57                             | litre (ℓ)                            |
| quart                  | x 1.1                              | litre (ℓ)                            |
| gallon                 | x 4.5                              | litre (ℓ)                            |
| <b>WEIGHT</b>          |                                    |                                      |
| ounce                  | x 28                               | gram (g)                             |
| pound                  | x 0.45                             | kilogram (kg)                        |
| short ton (2000 lb)    | x 0.9                              | tonne (t)                            |
| <b>TEMPERATURE</b>     |                                    |                                      |
| degrees Fahrenheit     | (°F-32) x 0.56<br>or (°F-32) x 5/9 | degrees Celsius (°C)                 |
| <b>PRESSURE</b>        |                                    |                                      |
| pounds per square inch | x 6.9                              | kilopascal (kPa)                     |
| <b>POWER</b>           |                                    |                                      |
| horsepower             | x 746<br>x 0.75                    | watt (W)<br>kilowatt (kW)            |
| <b>SPEED</b>           |                                    |                                      |
| feet per second        | x 0.30                             | metres per second (m/s)              |
| miles per hour         | x 1.6                              | kilometres per hour (km/h)           |
| <b>AGRICULTURE</b>     |                                    |                                      |
| gallons per acre       | x 11.23                            | litres per hectare (ℓ/ha)            |
| quarts per acre        | x 2.8                              | litres per hectare (ℓ/ha)            |
| pints per acre         | x 1.4                              | litres per hectare (ℓ/ha)            |
| fluid ounces per acre  | x 70                               | millilitres per hectare (ml/ha)      |
| tons per acre          | x 2.24                             | tonnes per hectare (t/ha)            |
| pounds per acre        | x 1.12                             | kilograms per hectare (kg/ha)        |
| ounces per acre        | x 70                               | grams per hectare (g/ha)             |
| plants per acre        | x 2.47                             | plants per hectare (plants/ha)       |

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VOLUME 11

NUMBER 4

AUGUST 1976

# CANADIAN FARM ECONOMICS



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Agriculture  
Canada

HON. EUGENE WHELAN, MINISTER — L. DENIS HUDON, DEPUTY MINISTER

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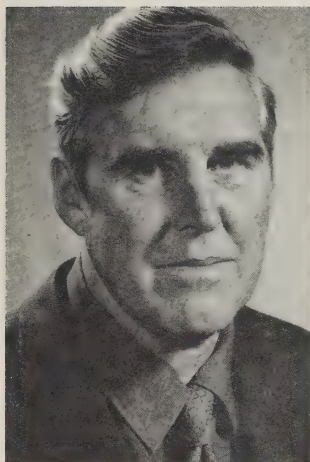
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**Letters from readers:** Letters are encouraged and should be addressed to the author or the Managing Editor. Responses...comments, suggestions and points of view are important for effective two-way communications. Letters may be used in the following issue of CFE and will be edited prior to publication where necessary.

# LIVESTOCK AUCTION MARKETS IN THE MARITIME PROVINCES



G.C. Retson\*

*Auction markets have expanded rapidly during the past 25 years. Few of those in operation today were established before 1950. Now they are a major competitor of terminal markets, livestock dealers and packer buyers.*

## INTRODUCTION

Limited information and in some cases a negative attitude toward auctions have obscured their importance. It is frequently assumed they are a by-product of decentralization which has occurred in the meat packing industry. New processing technology and developments in transportation have encouraged packers to locate smaller plants closer to sources of supply. This, combined with an increase in direct sales to packers, has resulted in a decline in the stockyards or terminal markets. Expansion in country auctions, it is suggested, represents a relocation of market facilities with local auctions supplying many of the services formerly provided by terminal markets.

In the Maritime Provinces there are no terminal markets, and little, if any increase, in direct sales to packers. Although there has been some decentralization of the meat packing industry, the growth of the auctions appears more directly related to their impact on marketing costs and returns to livestock producers. Data

secured from seven livestock auctions in New Brunswick, Nova Scotia and Prince Edward Island indicate the growth which has occurred in these establishments and some of their characteristics, problems and accomplishments.

Auction selling of livestock, such as fall feeder sales, has operated in the Maritime Provinces for many years. Establishment of auction markets, as currently operated, did not occur until 1954 when the first market was opened by the Sussex and Studholm Agricultural Society of New Brunswick. Development of auctions in New Brunswick was initiated by farm organizations and the Provincial Department of Agriculture and in the next few years auctions were set up at four other locations in the province. Of these four, only the auction at Florenceville, established by the Carleton County Co-operative in 1957, is in operation. Aside from the New Brunswick auctions and one organized at Lawrencetown, Nova Scotia, in 1956, all others in the region were established by private individuals. These include the auctions at Truro (1959) and Windsor (1972) in Nova Scotia, and at Charlottetown (1966) and O'Leary (1967) in Prince Edward Island. In addition, there were at least three small ones operating on a part-time basis in 1974, two of which went out of business during the year.

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\*G.C. Retson is Chief of the Atlantic Regional Office, Economics Branch, Agriculture Canada, Truro, Nova Scotia.

Auctions in New Brunswick and Prince Edward Island operate under provincial Livestock Community Sales Acts, but Nova Scotia has no comparable legislation. In contrast to the terminal markets, regulatory action is minimal and little information is available on their operations other than that included in the weekly market reports published by provincial departments of agriculture. The main purpose of these is to provide information on current livestock prices and little compilation or analysis of data on an annual basis is attempted. Analysis on a regional basis is further complicated by variations in reporting and by the fact that not all auctions operate on the same business year. Analysis of numbers and types of livestock sold was therefore confined to marketings for the 1974 calendar year and this, combined with additional data secured from auction officials, provided the basic data for the study.

## SALES

During the 1957-73 period, annual sales through the seven auction markets increased from \$562,069 to \$12,675,497, an average increase of 22.5 percent per year (Table 1). There was an upward trend in sales with minor variations associated with the establishment of new auctions and changes in livestock prices. In 1974 the first deviation in the trend occurred when sales dropped to \$9,578,480. Officials said this did not reflect a decline in popularity of auction selling, but was attributable to sharply lower prices for livestock and a reduction in numbers offered for sale. The decline in livestock sales in 1974 was general throughout the region, with deliveries to packing plants down 32.8 percent and total cash receipts from sale of cattle and calves 20.1 percent lower than in 1973.

Although much of the increase in sales is attributable to farmer preference for auction selling, other factors are involved. These include an upswing in the cattle cycle and rising livestock prices, which more than doubled during the 1957-73 period. Data on livestock numbers sold through the auctions, if available, would show a significant, but somewhat lower, increase.

## LIVESTOCK SALES

Cattle and calves were the main class of livestock sold through the seven auctions in 1974 (Table 2). Bob calves, consisting mainly of dairy calves from fluid milk producing areas of Nova Scotia and New Brunswick, were a major item of sale. Prior to the auctions there was limited demand and few outlets for sale of young calves and they are one of the classes of livestock which have

**TABLE 1. SALES THROUGH SEVEN LIVESTOCK AUCTION MARKETS AND CASH RECEIPTS FROM SALE OF LIVESTOCK IN THE MARITIME PROVINCES, 1957-74**

| Year | Auction Sales | Total Cash Receipts from Sale of Cattle, Calves, Hogs, Sheep and Lambs | Auction Sales as a Percentage of Total Cash Receipts |
|------|---------------|--|--|
|      |               | — dollars —  | — percent —  |
| 1957 | 562,069       | 25,088,000   | 2.2  |
| 1958 | 928,991       | 27,928,000   | 3.3  |
| 1959 | 1,314,422     | 28,620,000   | 4.6  |
| 1960 | 1,540,183     | 26,623,000   | 5.8  |
| 1961 | 1,809,994     | 28,674,000   | 6.3  |
| 1962 | 2,069,894     | 31,120,000   | 6.7  |
| 1963 | 2,223,361     | 28,509,000   | 7.8  |
| 1964 | 2,476,711     | 29,994,000   | 8.3  |
| 1965 | 2,968,303     | 34,073,000   | 8.7  |
| 1966 | 4,579,136     | 37,855,000   | 12.1   |
| 1967 | 5,259,765     | 39,426,000   | 13.3   |
| 1968 | 5,918,227     | 39,451,000   | 15.0   |
| 1969 | 6,935,304     | 46,305,000   | 15.0   |
| 1970 | 7,446,603     | 47,625,000   | 15.6   |
| 1971 | 7,778,044     | 44,698,000   | 17.4   |
| 1972 | 9,627,399     | 51,207,000   | 18.8   |
| 1973 | 12,675,497    | 62,608,000   | 20.3   |
| 1974 | 9,578,480     | 56,053,000   | 17.1   |

Source: Auction Reports and Statistics Canada.

benefited most from establishment of this market. Major buyers are dealers from Prince Edward Island who resell them to farmers in that province. Interprovincial movements are a factor in both demand and supply,

**TABLE 2. LIVESTOCK SOLD THROUGH SEVEN LIVESTOCK AUCTION MARKETS IN THE MARITIME PROVINCES, 1974**

| Type of Livestock            | N.B.       | N.S.   | P.E.I. | Total  |
|------------------------------|------------|--------|--------|--------|
|                              | — number — |        |        |        |
| Bob calves                   | 5,567      | 11,519 | 529    | 17,615 |
| Veal calves                  | 1,209      | 890    | 27     | 2,126  |
| Feeder calves                | 1,972      | 1,342  | 790    | 4,104  |
| Feeder cattle                | 2,649      | 4,613  | 6,890  | 14,152 |
| Slaughter heifers and steers | 877        | 1,403  | 3,434  | 5,714  |
| Slaughter cows               | 2,168      | 3,297  | 2,245  | 7,710  |
| Slaughter bulls              | 465        | 392    | 369    | 1,226  |
| Dairy cows                   | 279        | 702    | 342    | 1,323  |
| Dairy heifers                | 30         | 198    | 75     | 303    |
| Beef cows                    | 50         | 30     | 90     | 170    |
| Beef heifers                 | 23         | 46     | 35     | 104    |
| Beef bulls                   | 1          | 5      | —      | 6      |
| Sheep and lambs              | 2,342      | 3,358  | 300    | 6,000  |
| Feeder pigs                  | 22,582     | 3,938  | —      | 26,520 |
| Sows and boars               | 479        | 780    | 250    | 1,509  |
| Horses                       | 420        | 360    | 75     | 855    |
| Poultry                      | 4,173      | 350    | —      | 4,523  |

especially apparent in the spring of 1975, when there was a heavy movement of calves from Quebec. Quebec truckers who bring in livestock usually attempt to secure a return load (mainly sows and weanling pigs) and when a storm prevents Prince Edward Island dealers from coming to the mainland the price of calves at Truro and Sussex drops substantially.

Six auctions reported an upward trend in the sale of bob and feeder calves during the past five years, but only three reported an increase in the sale of veal calves (Table 3). There was an upward trend in feeder cattle sales, particularly in Prince Edward Island. Auction sales of feeder cattle would probably be higher in the absence of fall and spring sales conducted by other agencies. Slaughter cattle were an important item and four of the seven auctions reported an increase in sales of steers. Two auctions reported an increase in sales of heifers, but five indicated little or no change in sales of slaughter cows during the past five years. Auction managers reported that good quality steers were in shortest supply, while slaughter cows, bob calves and light weight dairy feeders were most readily available.

**TABLE 3. TRENDS IN KINDS OF LIVESTOCK SOLD THROUGH SEVEN LIVESTOCK AUCTION MARKETS IN THE MARITIME PROVINCES, 1969-74**

| Kind of Livestock | Auctions Reporting     |           |                  |
|-------------------|------------------------|-----------|------------------|
|                   | Sales Increasing       | No Change | Sales Decreasing |
|                   | — number of auctions — |           |                  |
| Bob calves        | 6                      | —         | 1                |
| Veal calves       | 3                      | —         | 4                |
| Feeders           | 6                      | —         | 1                |
| Slaughter cows    | 2                      | —         | 5                |
| Slaughter steers  | 4                      | 1         | 2                |
| Slaughter heifers | 2                      | 1         | 4                |
| Dairy cows        | 2                      | 2         | 3                |
| Dairy heifers     | —                      | 1         | 6                |
| Beef cows         | 5                      | —         | 2                |
| Beef heifers      | 4                      | —         | 3                |
| Swine             | 2                      | 1         | 4                |
| Sheep and lambs   | 1                      | 1         | 5                |
| Others            | 1                      | —         | 6                |

Sales of cows for milk production or breeding purposes were a minor item at auctions in 1974. Since dairying is the predominant type of livestock farming in the region, it might be expected that dairy replacements would be an important item of sale. However, as auctions provide a major market for cull cows, the general assumption is that cows offered for sale are probably culls, and resulting prices discourage the sale of dairy and beef breeding stock. While less applicable, the same assumption appears to apply to heifers as sales in 1974 were even lower than for cows. Auction managers suggested

that increased use of their facilities for dispersal or special dairy or beef sales might improve this situation. One advantage of such sales is that commission charges are higher and provide compensation for the extra time required to sell breeding stock, which is about double that required for slaughter animals.

Sale of market hogs in the Maritime Provinces is controlled by provincial marketing boards and they are not available for sale at livestock auctions. Auction sales of swine in 1974 consisted mainly of feeder pigs and some sows and boars. Sales of feeder pigs at New Brunswick auctions were much higher than elsewhere, mainly as a result of purchases by truckers from Quebec. The New Brunswick auctions also secured some revenue from rental of their facilities as marketing board assembly points. Sales of other livestock, which were of minor importance, included sheep and lambs, horses, ponies, goats, poultry and dogs. Most auctions also secured some income from sales of non-livestock items such as used farm machinery and household appliances.

Data in Tables 1 and 2 indicate that auctions have become an important factor in livestock marketing in the region, particularly for cattle and calves. In 1974, sales of cattle and calves through the seven regular auctions totalled 54,553 head, more than two thirds of total sales for the three provinces. Although some double counting is involved, in that the same animal may be sold and resold through the auctions, sales were for the seven regular auctions only and do not include those through part-time auctions or those which terminated operations during the year.

Table 1 shows that total cash receipts include sales of market hogs as well as breeding stock and some other classes of livestock previously noted, which are not normally sold through the auctions.

## CAPITAL INVESTMENT

Capital investment in livestock auctions ranged from \$22,250 to \$125,000, with an average of \$74,993 per auction (Table 4). It consisted mainly of the sales barn with its yards, pens, sales ring and seating area. Three auctions also had canteens, the operation of which was rented out. Equipment included scales, P.A. equipment and office furniture and machines. The relatively low level of investment reflects the influence of a number of factors, including age and condition of buildings, the use of some rented buildings by two auctions and the fact that three of the seven were conducted in conjunction with other operations and had free access to parking lots and railway sidings. The wide range in sales per dollar of

investment (Table 4) reflects the position of an older auction with weekly sales and the advantages noted above, versus a newly established auction with no shared costs and operated on a bi-monthly basis.

**TABLE 4. AVERAGE CAPITAL INVESTMENT AND SALES PER DOLLAR OF INVESTMENT, SEVEN LIVESTOCK AUCTION MARKETS IN THE MARITIME PROVINCES, 1974**

|                                 | — dollars — |
|---------------------------------|-------------|
| Land and buildings              | 69,429.00   |
| Equipment                       | 5,564.00    |
| Total                           | 74,993.00   |
| Sales per Dollar of Investment: |             |
| High Auction                    | 47.39       |
| Low Auction                     | 1.40        |
| All Auctions                    | 18.25       |

Management of livestock auctions involves a number of decisions concerning where, when, and how business will be conducted. One of the initial decisions is plant location. As most of the auctions were set up on a trial basis, there was a tendency to hold initial investment to a minimum. This resulted in use of rented or older buildings, some of which were not well adapted to auction operations. Three of the auctions had relocated their operations and one reported a total of three moves prior to selection of the current site. Managers noted a number of revisions or improvements they would recommend in any rebuilding or relocation program, most of which were designed to facilitate control and movement of livestock and reduce labor requirements.

## LABOR

Labor is the major expense and usually accounts for one half to two thirds of auction operating costs. As a number of jobs were performed on a group basis, a detailed breakdown of labor requirements was difficult to secure, and analysis in Table 5 is confined to major activities. The item, yarding, involves a number of operations including unloading, tagging, weighing, recording, and moving livestock to holding pens, in and out of the sales ring, to buyers' pens, and finally to loading ramps. Selling includes operations performed by auctioneers and their clerks, and accounting includes the work of office personnel in processing accounts. These operations, together with the post-sale clean up, were performed at all auctions and provide a basis for analysis of labor efficiency. Time spent on other work varied considerably from auction to auction and included items such as promotion, travel, transportation and other operations more directly associated with increasing receipts than in meeting plant labor requirements.

**TABLE 5. LABOR REQUIREMENTS PER AUCTION AND PER DOLLAR OF SALES, SEVEN LIVESTOCK AUCTION MARKETS IN THE MARITIME PROVINCES, 1974**

| Operation  | Hours per Auction Sale | Minutes of Labor Per Dollar of Sales |              |              |
|------------|------------------------|--------------------------------------|--------------|--------------|
|            |                        | Low Auction                          | High Auction | All Auctions |
| Yarding    | 71                     | .07                                  | .62          | .13          |
| Selling    | 12                     | .01                                  | .12          | .02          |
| Accounting | 20                     | .02                                  | .22          | .04          |
| Cleaning   | 12                     | .01                                  | .08          | .03          |
| Other      | 19                     | .02                                  | .15          | .03          |
| Total      | 134                    | .13                                  | 1.19         | .25          |

## SALES DAYS

Four of the auctions operated on a weekly basis and three held sales every other week. Frequency of sales was based on supplies of livestock. Selection of the regular sales day was influenced by a number of factors, the most important being competition with other auctions for buyer attendance. Sales days included all days of the week except Friday and Sunday, with Monday to Wednesday preferred. This indicates that slaughter cattle were a major item of sale and packers preferred buying early in the week. Monday was selected by one farm organization to minimize conflicts with other business conducted during the week. However, as livestock proceeding to the auction from distant points had to be shipped on Sunday, added transportation and holding problems were involved. A further problem was the increased designation of Monday as a holiday. Saturday, selected as the sales day by another auction because of its traditional association with farmer marketing, was not popular with dealers. Objections included lateness in the week and attendance of non-buyers who hindered inspection of livestock and interfered with the sale operations.

Starting time for auctions ranged from 10 a.m. to 1 p.m., with all livestock expected to be on hand before these hours. Initially, some auctions levied a penalty for late arrivals, but all had subsequently dropped this charge. As a result of farmer objection to morning deliveries some auctions had also discontinued morning sales. Most auctions followed a regular schedule, with bob calves being the first item offered for sale, followed by other calves and weanling pigs. If the auction had a morning sale the period immediately prior to or following the dinner hour was used to sell odd lots of livestock, horses, sheep, poultry, and non-livestock items. This was followed by dairy and beef cows with the sale of feeder and slaughter cattle usually being the

final item of sale. Sales were usually completed by 6 p.m., but in some cases, due to heavy runs of livestock, lasted until late evening. There was little problem over unsold livestock, but some buyers left their purchases at the auction to be picked up on the following day. Some auctions levied a charge for livestock left on the premises, but most did not.

## COMMISSIONS

Auction commission rates were from 3 to 5 percent of sales with some added provisions. One auction charged 3 percent for all animals more than 400 pounds and 5 percent for those under this weight. Another charged 4 percent for sales up to \$125 with a maximum charge of \$5 an animal. A third auction charged 4 percent of the selling price plus an additional charge of \$2 an animal if the seller was not a member of the farm organization operating the sale. Another auction charged 3.5 percent for cattle and 5 percent for other livestock or non-livestock items. Three auctions also gave discounts for large consignments of livestock.

## RESERVE BIDS

All auctions accepted reserve bids<sup>1</sup>, but most discouraged the practice. Charges for them ranged from 50 cents to \$3, with \$1 being the usual charge. The reserve bid of 50 cents by one auction was restricted to bob calves and weanling pigs. Another auction charged \$1 for calves and \$2 for all other reserve bids. Managers said that charges for reserve bids were too low, but since they had some promotional value or, with the exception of one auction were seldom requested, little change in policy was anticipated. Their main use was in the sale of breeding stock which tended to sell at a discount.

The use of reserve bids and maximum charges per animal reduced auction receipts and in some cases appeared to be a weak point in financial control. Charges for reserve bids were generally well below the cost of selling an animal. At one auction, where reserve bids were placed on about half of the livestock offered for sale, it was estimated they reduced the commission rate by .5 percent. The provision of maximum charges per animal also cuts receipts, particularly in years of high prices. At one auction in 1973, receipts were only 2.4 percent of gross sales. Discounts for volume consignments were a minor factor influencing returns as they were confined largely to special sales where higher selling charges tended to offset any reduction in receipts.

## TERMS OF SALE

Payment for livestock purchased at auctions was by cash, or by cheque if the buyer was known or could be vouched for. Losses on bad debts ranged from .3 to .5 percent of sales in recent years. One auction had suffered a major loss some years before when an unknown buyer purchased \$3,600 worth of livestock, submitted a bad cheque in payment and then disappeared. Payment to sellers was by cheque issued from the office, which in some cases was located directly below the auctioneer. Following the final bid on an animal the sales slip was dropped down a connecting chute for processing and sellers who wished to do so could pick up their cheques a few minutes later.

## AUCTION RESPONSIBILITIES

Aside from providing facilities for conduct of the sale, auction responsibilities were rather minimal. While there was some question of its legality, responsibility for damage to or from livestock was assumed to be that of the seller up to the point of sale, and thereafter that of the buyer. However, on the few occasions when such problems occurred, auctions usually made compensating payments. As a further point of public relations, they also assumed some responsibility for protecting sellers against buyer collusion. Related action had included purchase of livestock by the auction and provision for termination of the sale if bids were out of line with current market quotations.

## SUPPLY

Since they produce only about one third of their requirements for beef and lamb and half for pork, supply is a major problem of livestock marketing in the Maritime Provinces. Data in Table 6 indicate that auctions in Prince Edward Island were more favorably located in respect to supplies than those elsewhere. This reflects a heavier concentration of livestock plus the fact that auctions in Prince Edward Island were relatively new and presumably expanding their operations. Auctions operated by farm organizations tended to be more service oriented and less involved in supply considerations than those conducted by private operators. Most auctions reported some promotional work to attract supplies and buyers, and all agreed that more advertising was desirable. One related problem was that of securing advance notice from farmers on the number and types of livestock they planned to bring to the auction. While farmers were the major source of supply, some auctions secured up to one quarter of their livestock from dealers.

<sup>1</sup>A reserve bid is a minimum acceptable price placed on an animal by the owner and for which he pays a reserve-bid charge if the animal is not sold.

**TABLE 6. SOURCES OF SUPPLY OF LIVESTOCK SOLD AT SEVEN LIVESTOCK AUCTION MARKETS IN THE MARITIME PROVINCES, 1974**

| Distance from<br>Auction | Percent of Livestock Secured from this Distance |                  |                    |
|--------------------------|---|------------------|--------------------|
|                          | N.B.<br>Auctions                                | N.S.<br>Auctions | P.E.I.<br>Auctions |
| — miles —                |   | — percent —      |                    |
| Less than 15             | 22.5  | 20.0             | 52.5               |
| 15 to 25                 | 32.5  | 31.7             | 30.0               |
| 26 to 50                 | 21.5  | 31.6             | 17.0               |
| 51 to 100                | 16.0  | 15.0             | 0.0                |
| More than 100            | 7.5   | 1.7              | 0.5                |

## MARKETING COSTS

Because of the deficit supply situation, market facilities frequently operate below capacity and marketing costs including assembly, transportation, and processing of livestock, are higher than in most other regions of Canada. Prior to the auctions, most initial purchases were made at the farm, with buyers travelling from farm to farm and picking up livestock where, and if available. Because of the scattered location of farming areas, this was an expensive procedure and the high cost involved was frequently reflected in low prices paid for livestock. With the growth of the auctions, farm buying has declined and data secured from seven large buyers in the region indicated that 64 percent of their current livestock purchases were made at auctions, 34 percent from farmers and 2 percent from other dealers. Increasing costs of transportation were cited as the main reason for the switch from farm to auction buying, but other factors were involved. These included a decline in number of dealers, increased emphasis on volume, greater opportunity for selection and the added convenience of auction facilities for buying, handling and loading livestock. Location was a factor influencing costs and one dealer operating in close proximity to a sales barn noted that his hourly purchases at the auction were frequently equal to those acquired in a day spent on the road. Another dealer stated that with the switch from farm to auction buying his total annual mileage had been reduced 25,000 miles.

Auction buying has cut dealer assembly costs, but has resulted in added charges to the farmer for commissions and delivery of livestock to the sales barn. The substantial increase in auction selling, however, suggests that these costs are more than covered by higher prices for livestock. Cattle marketed through auctions are sold under much more competitive conditions than was formerly the case. Furthermore, competition is not confined to commercial buyers, as auctions are well attended by farmers and others whose bids provide

added insurance that livestock are sold at or near their full market value. Other factors contributing to farmer preference for auction selling were that delivery costs were frequently shared with a return load of livestock or farm supplies and commission rates had changed little over the years. Rising livestock prices mean higher commission charges, but these are offset by higher returns per animal. When prices decline as they did in 1974, the farmer pays a lower commission charge.

A further benefit of the auctions is their value in acquainting farmers with prices and other aspects of market demand. Market reports, while useful, are no substitute for seeing animals sold on the hoof and observing the factors which influence prices paid for them. Average seating capacity at the seven auctions was 289 and attendance, which varied considerably through 1974, averaged 254 persons per auction. Data from a sample group of farmers indicated that auction attendance was highest in October and November, with an average of three sales per farmer each month. From December to February attendance declined and then rose to over two trips per farmer in March. From March to May it declined, reaching a low point in June, July and August, when attendance was about one trip per month.

Comments by farmers emphasized local market limitations and the value of auctions as regular, convenient, and alternative outlets for the sale of livestock. Although some concern was expressed over buyer collusion and lower prices than those reported in Central Canadian markets, there was general agreement that auctions had cut marketing costs and increased returns to livestock producers. Managers agreed that prices for top grades of cattle at local auctions were lower than in Central Canada, but said that for the lower grades, prices were generally higher. Furthermore, price comparisons overlooked the fact that dressing percentages of top grades of cattle in the region were somewhat lower than those elsewhere in Canada. There was some concern over sanitation and related problems of disease control. It was suggested that more emphasis should be placed on rejection of defective animals. Government programs which include payments for tagging slaughter cattle, as a disease identification measure, and some grading and promotional work vary considerably within the three provinces and were felt to be rather minimal.

In view of their more numerous contacts comments by dealers tended to emphasize the relative merits or shortcomings of various auctions. It was suggested that more consideration should be given to seating arrangements and control of movement which interfered with display of livestock. There was some criticism of

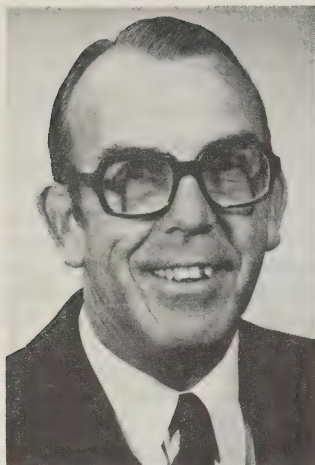
weighing, particularly when done shortly after animals were unloaded. Considerable shrink could occur in the interval between time of arrival and the sale of an animal and weighing should be done immediately before its entry into the sales ring. There was some complaint of penning, tying and handling arrangements (particularly for bulls) and inadequacy of parking space.

As packers secure their hogs from marketing boards and handle few sheep, their main interest in auctions was as a source of slaughter cattle. It was noted that continuity of supply of good quality cattle was a major problem in the region and auctions had not been able to meet the requirements in this regard. If all purchases were made through auctions, marketing costs might decline. In view of the short supply situation packers had to maintain

buyers in all areas of supply and there had been little or no reduction in their marketing costs.

Many of the deficiencies were weak points in individual auctions and must be balanced against their overall accomplishments in terms of sales, services and increased utilization by farmers and livestock buyers. One of the more significant characteristics of the auctions is that they have concentrated on low cost marketing, an essential requirement in an area of deficit production. Emphasis on low-cost marketing is no excuse for inadequacies of management, but is generally associated with some limitation in the services which can be provided. Since their facilities and operations are less impressive than those of many other marketing organizations, the accomplishments of the auctions tend to be overlooked and taken for granted more than appreciated.

# CANADIAN CO-OPERATIVES — THEIR GROWTH AND FINANCE



C.E. Hill\*

*The business volume of marketing and supply co-operatives was \$4.8 billion in 1974, an increase of \$1.3 billion from the 1973 level. Grain sales represented 66 percent of the value of farm products marketed through co-operatives.*

## INTRODUCTION

The co-operative movement in Canada goes back to the end of the last century although the majority of co-operatives were established between 1910 and 1930. Statistics have been published annually by Agriculture Canada's Economics Branch since 1932 and have served as the major source of information on co-operatives.

This article examines trends in the co-operative movement in Canada, using the latest Economics Branch statistics<sup>1</sup>. There are some 2,250 co-operatives, which provide data from their yearly financial statements.

The article concentrates on trends in the last five years, when high rates of inflation have prevailed, to see whether marketing and supply co-operatives have continued to increase their share of the agricultural market. There is evidence from some other countries that the more limited sources of capital open to co-operatives, compared with competing businesses, have restricted co-operative growth under inflationary conditions.

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<sup>1</sup>Co-operation in Canada. J.M. Sullivan, 1976. Economics Branch, Agriculture Canada, Ottawa. 26 pp. Publication 76/4.

## TYPES OF CANADIAN CO-OPERATIVES

Most co-operatives are both rural and agricultural (or horticultural), but during the past 20 years an important development has been the growth of consumer co-operatives serving the urban population<sup>2</sup>.

There are four main groups of co-operatives serving the individual. These are:

### (1) Marketing and Supply (Purchasing) Co-operatives

As the name implies, these co-operatives market produce on behalf of farmers and sell farmers the supplies needed in their businesses. Many also sell general merchandise to consumers.

### (2) Production Co-operatives

There are three main types of production co-operatives. These are livestock feeder groups, found mainly in Alberta and Saskatchewan, the lumber and pulpwood co-operatives of Quebec, and the artificial insemination co-operatives found throughout Canada.

<sup>2</sup>Credit Unions, insurance and recreational associations are excluded from this analysis.

### (3) Fishermen's Co-operatives

On the whole, these specialize in the marketing of fish and only to a limited extent provide any other services. They are found in every province of Canada.

### (4) Service Co-operatives

There are a wide range of services undertaken on a co-operative basis including dental insurance, housing, restaurant ownership, funeral, printing, telephone, rural electricity and seed cleaning.

The other important group are the wholesale organizations whose primary function is to supply the local co-operatives. Statistically, these co-operatives create a problem. Normally the sales of the wholesale co-operatives are omitted from global co-operative statistics since inclusion of their sales to the local co-operatives would result in double counting. Their exclusion does mean that the extent of co-operative business is significantly understated since the wholesales have a considerable trade, particularly livestock marketings, that does not go through local co-operatives. Nevertheless, the wholesale co-operatives are omitted from the subsequent analysis in this paper. Steps are being taken to enable direct sales and wholesale trading to be separated in future years.

For reasons of space, this paper is confined to the most important group — the marketing and supply co-operatives.

## MARKETING AND SUPPLY CO-OPERATIVES

As noted earlier, the main-stream Canadian co-operatives have been in existence for about fifty years and have become an accepted part of the agricultural scene. Because their development and growth has been for the most part steady and unspectacular, their significance in the agricultural scene may have tended to be underestimated or unnoticed. The co-operatives now have an important and established role in agriculture, both in marketing and supply, and the events of the past three years, particularly 1974, suggest that they are now a major force in several main commodity fields.

There are 1,123 marketing and supply co-operatives in Canada, representing 49 percent of all registered co-operatives. They are by far the most important group and in 1974 accounted for 97 percent of total co-operative business.

The evolution of these co-operatives over the years is of interest. The level of activity both in marketing and supply remained relatively static from 1932 to the start of the second world war. From then on, there was a regular and steady increase in trade up to 1970. Since that date, the growth in trade has been meteoric (Figure 1).

Even as recently as 1956 the total annual turnover of marketing and supply co-operatives was barely \$1 billion. It had taken 30-40 years to reach that mark. This turnover doubled to \$2 billion in only 11 years, and by 1973 had tripled to \$3 billion.

Even this rate of growth was surpassed in 1974 when the volume of business reached \$4.8 billion, an incredible increase of \$1.3 billion or 40 percent, in one year. Marketing turnover increased 47 percent and the supply value 31 percent.

During the same period, the index of farm input prices rose 16.9 percent. This suggests that about half the increase in the sales value of merchandise and supplies may have been due to inflation.

On the marketing side, part of the increase in 1974 was due to an increased share of the market, but the main factor was the record price increases of some agricultural commodities, particularly grain (Table 1).

**TABLE 1. VALUE OF FARM PRODUCTS MARKETED THROUGH CO-OPERATIVES**

|                  | 1974           | 1973  | Increase    |
|------------------|----------------|-------|-------------|
|                  | — \$ million — |       | — percent — |
| Grains and seeds | 2,268          | 1,287 | 76          |
| Livestock        | 330            | 363   | - 9         |
| Dairy products   | 643            | 514   | 25          |
| Poultry & eggs   | 103            | 99    | 4           |
| All other        | 116            | 94    | 23          |
| Total            | 3,460          | 2,357 | 47          |

These figures show the importance of grain to the co-operative sector. Grain sales represent 66 percent of the total value of produce marketed by co-operatives, but only 35 percent of total farm cash receipts.

In a period of inflation, it is not easy to detect the underlying trends in the growth of co-operatives. Can they maintain and increase their market share in competition with the private trade under these conditions? The best answer to this question is probably obtained by examining the co-operative market shares over a period of time (Table 2).

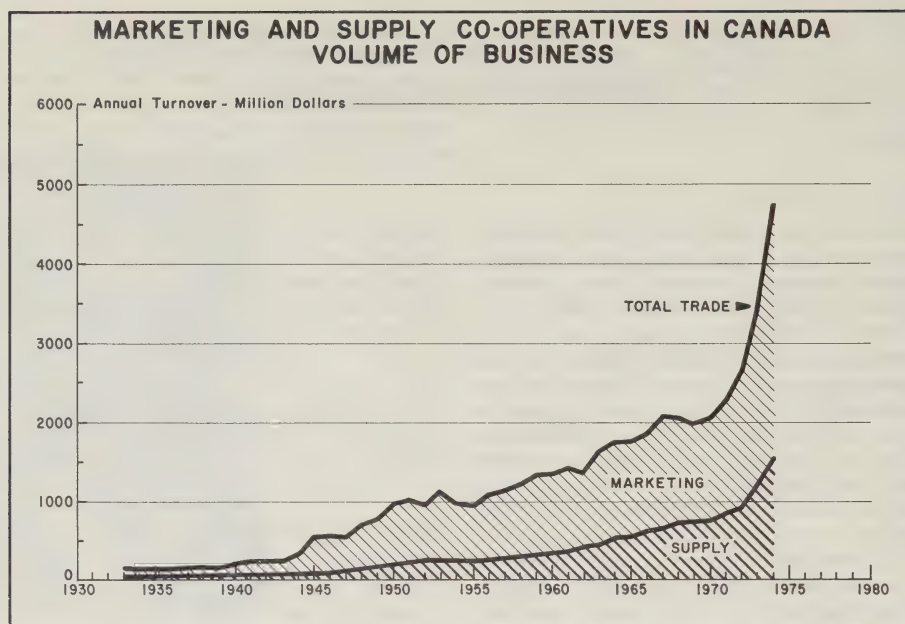


Figure 1

**TABLE 2. THE VALUE OF FARM PRODUCE MARKETED BY CO-OPERATIVES IN RELATION TO TOTAL FARM CASH RECEIPTS**

| Commodity        | Marketing & Supply Co-operatives<br>Value of Produce Marketed |       |      |                    | Total Farm Cash**<br>Receipts |       |       |                    | Co-operative Share<br>of the Market* |      |      |                    |
|------------------|---|-------|------|--------------------|-------------------------------|-------|-------|--------------------|--------------------------------------|------|------|--------------------|
|                  | 1974  | 1961  | 1951 | Average<br>1935-39 | 1974                          | 1961  | 1951  | Average<br>1935-39 | 1974                                 | 1961 | 1951 | Average<br>1935-39 |
|                  | — \$ million —<br>1   |       |      |                    | — \$ million —<br>2           |       |       |                    | — Col. 1 as % of Col. 2 —<br>3       |      |      |                    |
| Grains and seeds | 2,268   | 427   | 336  | 99                 | 2,859                         | 751   | 881   | 194                | 79                                   | 57   | 38   | 51                 |
| Livestock        | 330   | 271   | 193  | 13                 | 2,223                         | 906   | 865   | 152                | 15                                   | 30   | 22   | 9                  |
| Dairy products   | 643   | 229   | 117  | 15                 | 1,086                         | 496   | 248   | 47                 | 14                                   | 15   | 31   | 14                 |
| Poultry & eggs   | 103   | 44    | 26   | 3                  | 746                           | 284   | 47    | 14                 | 15                                   | 10   | 10   | 6                  |
| Other            | 116   | 47    | 97   | 19                 | 1,286                         | 486   | 370   | 120                | 9                                    | 10   | 26   | 16                 |
| Total            | 3,460   | 1,018 | 769  | 149                | 8,200                         | 2,923 | 2,736 | 624                | 42                                   | 35   | 28   | 24                 |

\*Note: — These figures are intended to indicate trends rather than absolute shares of the market. The industry figures are farm gate sale values while for certain commodities, notably dairy and poultry, the co-operative sales include the value of products which have been processed. For these commodities, there will be an element of over-statement.

\*\* These figures exclude dairy supplementary payments and deficiency payments.

The marketing co-operatives have had a continuing and significantly increasing share of the market over the last 40 years. Since 1951, this share has increased one half from 28 to 42 percent.

This market share figure conceals two opposing trends. On the positive side, co-operatives now market 79 percent of Canada's grain production and this is still on an uptrend. Similarly, co-operative production and

distribution of milk and dairy products continues to expand. In 1974 nearly 60 percent of all dairy products was marketed by co-operatives, nearly twice as much as in 1951 and four times as much as in the late thirties. The proportion of poultry and eggs sold by co-operatives has increased over the last 20 years but now seems to have levelled out.

The exception to this general increasing trend is livestock. While the co-operatives' market share increased from 9 percent in the 1935-39 period to 30 percent in 1961, since then it has decreased to the present level of about 15 percent. It is in livestock, however, that the omission of the wholesale co-operatives is most significant. The value of direct livestock marketings by two wholesale organizations totalled \$165 million in 1974 and its inclusion would raise the co-operative share of the livestock market to 22.3 percent in that year.

An important factor in the decline in co-operative livestock marketing has been the setting up of hog marketing boards during the past 10 years. Much co-operative trade in livestock has been transferred to the boards, which now handle \$550 million or 25 percent of all livestock.

The supply side of the co-operative business is relatively new compared with the long-established marketing role. Until 1940, the purchasing of supplies was a minor activity of what were principally marketing co-operatives (Table 3).

**TABLE 3. MARKETING AND SUPPLY CO-OPERATIVES PURCHASING AS A PERCENTAGE OF TOTAL BUSINESS**

|      | — percent — |
|------|-------------|
| 1935 | 6.3         |
| 1940 | 8.9         |
| 1945 | 13.9        |
| 1950 | 20.3        |
| 1955 | 24.3        |
| 1960 | 26.9        |
| 1965 | 31.0        |
| 1970 | 35.8        |
| 1974 | 32.5        |

This development contrasts sharply with the history of co-operatives in the United Kingdom and parts of Europe where they were originally established for the bulk purchasing of supplies for farmers and only much later entered the marketing field. Once the Canadian marketing co-operatives went into the purchasing business, however, growth was rapid and by 1965, about

one third of turnover was in this type of trade. Over the last 10 years, co-operative business appears to have stabilized at the two-thirds marketing, one-third supply level.

It is more difficult on the supply side to give precise estimates of the importance of co-operatives but a rough comparison can be made of their proportion of total sales of producers of machinery, fertilizers, manufactured feeds, general farm supplies and farm building materials. For the 1935-39 period, about 6 percent was supplied by co-operatives. This rose to about 15 percent by 1961 and just under 20 percent in 1974. The 1974 figures suggest that co-operatives have about 9 percent of the farm machinery market (4 percent in 1961) and 30 percent of the feed manufacturing industry.

## THE FINANCIAL STRUCTURE OF CO-OPERATIVES

The paper has shown that the marketing and purchasing co-operatives in Canada have been continually increasing their volume of agricultural business throughout the past 40 years and that this rate of growth has accelerated sharply during the last five years. The financing of growth and inflation has demanded the injection of large amounts of capital into co-operatives (Table 4).

**TABLE 4. TOTAL CAPITAL EMPLOYED BY MARKETING AND SUPPLY CO-OPERATIVES**

|      | — \$ million — |
|------|----------------|
| 1932 | 70.2           |
| 1941 | 145.7          |
| 1951 | 306.8          |
| 1961 | 617.9          |
| 1971 | 1,060.2        |
| 1972 | 1,164.8        |
| 1973 | 1,302.6        |
| 1974 | 2,032.0        |

The financing of co-operatives creates special problems because of the fundamental differences existing between them and other types of incorporated businesses. Investment in private companies takes place mainly with the hope and objective of making a profit on that investment. It is the profit motive that stimulates investment. In co-operatives, this is not true and, by definition, the return on capital investment must be restricted to modest levels and any surplus must be distributed to members in proportion to the use each member makes of the society's facilities and not according to the shareholding each has in the co-operative. Similarly, the fundamental principle of democratic control whereby

each member has one vote irrespective of the size of shareholder is a deterrent to the "outside" investor used to having an influence on the running of a business that is directly related to the size of his investment. Finally, the private investor is used to increasing share values as asset values increases. Shares are repayable in a co-operative and remain at par value irrespective of the co-operative's financial worth.

The net effect of these co-operative characteristics is to limit the source of long-term capital in the business almost exclusively to trading members either through an initial shareholding — normally a prerequisite of membership although usually modest in size — or by subsequent re-investment of surpluses. In practice, the co-operative surpluses represent the source of most member equity whether retained as reserves or allocated to members but retained in the business as shares or loan capital. With co-operatives, success breeds growth. Given a good profit or surplus, the basis for growth exists. In difficult, non-profitable years, the opportunity for development is removed.

This general statement remained true up to the last few years in most co-operative organizations in the developed countries. Growth has been financed out of surplus. The high rate of inflation over the past few years has in some countries changed this picture. In the United Kingdom, for example, despite good profit records, the co-operatives have found that capital generated by the business was sufficient only to cover the increased working capital required to operate their existing business and little, if any, was left for expansion. A recent report on the subject concluded that a number of marketing co-operatives had had opportunities for development but had been hesitant to accept them because of lack of investment capital<sup>3</sup>.

Evidence suggests U.S. co-operatives may have encountered the same problems. A recent United States Department of Agriculture publication shows that between 1960 and 1970 non-co-operative agri-business sales increased \$45.3 billion, total assets \$50.2 billion and net worth \$21.9 billion. It would appear that about 44 percent of this new capital was equity capital. During the same period, farm co-operative sales increased \$5.5 billion, total assets \$2.8 billion and net worth \$900 million. In the case of co-operatives, members found only 32 percent of the expansion capital even though the rate of growth of co-operatives was slower than that of their non-co-operative competitors.

<sup>3</sup> Report of the Working Party on Investment Capital in Agricultural Co-operatives, Central Council for Agricultural and Horticultural Co-operation, London 1975.

How have Canadian co-operatives found the capital for the growth of the last few years? It is worth re-emphasizing that to date they have continued to expand their share of the market (Table 2). If finance has been a problem, there is no evidence that to the end of 1974 it had retarded development. There are strong indications, however, that that point may not be far off if inflationary conditions continue over the next few years.

Figure 2 shows the proportion of total capital employed in the marketing and supply co-operatives that was provided by members.

While the members' stake in the co-operatives fluctuates from year to year, (it will be shown later that this is due to variations in outside borrowings and not in members' capital), there is a definite downward trend in members' equity. Although there is no golden rule about the optimum level of members' capital, a situation where the amount of members' money matched borrowings from outside sources would be considered by many people as a desirable indication of financial stability and balance. With one exception, it is nearly 25 years since that situation existed. Nevertheless, members' equity remained steady at about 45 percent during the fifties. The lower level of trading in 1961-62, and the resulting reduction in the need for short-term borrowing, produced an artificial improvement in the proportion of members' equity, but this was short term, and the downward trend continued. The sharp increase in capital requirements to finance inflation and high-priced commodity inventories in 1974 could not be met from internal sources, however, and the large increase in outside borrowings reduced the share of members' equity from 45 percent of total assets in 1973 to 34 percent in 1974. It is of interest to see how this increase in working capital was found (Table 5).

The co-operatives were faced with an increased capital requirement in 1974 of \$729 million, a step-up of 56 percent in one year. Of this, only \$105 million, or 14 percent, was owned equity—mostly from allocation of surplus to reserves or retained in some other way. Most of the new capital was short-term. Increased bank borrowing (which more than doubled) was \$420 million and the amount owing to creditors also doubled, increasing by \$186 million.

It says a great deal for the stability and reputation of the marketing and supply co-operatives as efficient business units that they were able, with apparently little difficulty, to raise these large sums of working capital. One would suppose that if capital requirements remain at this level, or even increase, this method of funding would not

# MARKETING AND SUPPLY CO-OPERATIVES MEMBERS' EQUITY AS PERCENT OF TOTAL ASSETS

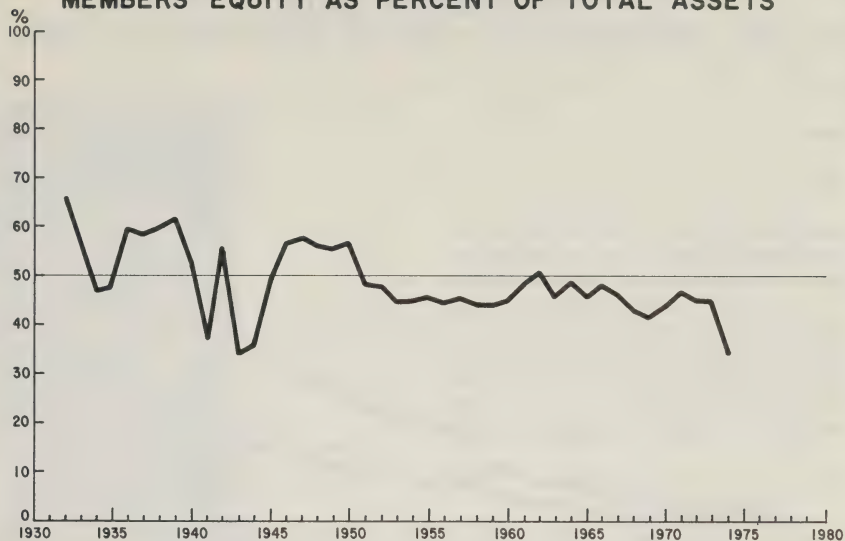


Figure 2

TABLE 5. BALANCE SHEET OF MARKETING AND SUPPLY CO-OPERATIVES

|  | 1973           | 1974        | Increase    |
|--|----------------|-------------|-------------|
|  | — \$ million — |             | — percent — |
| <b>Assets</b>  |                |             |             |
| Cash   | 48             | 47          | - 2         |
| Receivables  | 214            | 268         | 25          |
| Inventories  | 496            | 1,104       | 123         |
| Other current  | 13             | 17          | 21          |
| Property and Equipment                                   | 396            | 453         | 14          |
| Investments  | 124            | 122         | - 2         |
| Other Assets   | 12             | 21          | 75          |
| Total Assets   | 1,303          | 2,032       | 56          |
| <b>Liabilities to the Public</b>                         |                |             |             |
| Short-term Loans   | 298            | 718         | 141         |
| Accounts Payable   | 192            | 378         | 97          |
| Other Current  | 29             | 35          | 21          |
| Long-term Loans  | 202            | 214         | 6           |
| Total  | 721            | 1,345       | 87          |
| <b>Members' Equity</b>                                   |                |             |             |
| Members' Loans   | 54             | 58          | 7           |
| Patronage Loans  | 72             | 88          | 22          |
| Share Capital  | 216            | 245         | 13          |
| Reserves   | 136            | 153         | 13          |
| Surplus  | 104            | 143         | 38          |
| Total  | 582            | 687         | 18          |
| <b>Members' Equity as<br/>Percentage of Total Assets</b> | <b>44.7</b>    | <b>33.8</b> |             |

be a long-term solution. A situation where members' equity drops to one third must cast doubt on the ability of co-operatives to generate sufficient surplus to finance growth at the current rate.

Table 5 shows that \$608 million of the additional \$729 million in capital was required to finance the higher value of stock inventories, of which about \$450 million was required by the grain co-operatives. Some of the 1975 results show a reduction in inventory value by the grain marketing co-operatives because of lower commodity values. On the supply side, there are indications that the problems of capital-raising continued in 1975, but the percentage share of members' equity was maintained at about the 1974 level.

The problems of co-operative finance can be summarized in Figure 3.

It shows (1) the gradually-widening gap between member equity and public liability, and (2) the particular problem of 1974. It also demonstrates clearly how member equity increases smoothly and steadily from year to year, generated from the surplus retained in the co-operatives. Except for the general upward trend,

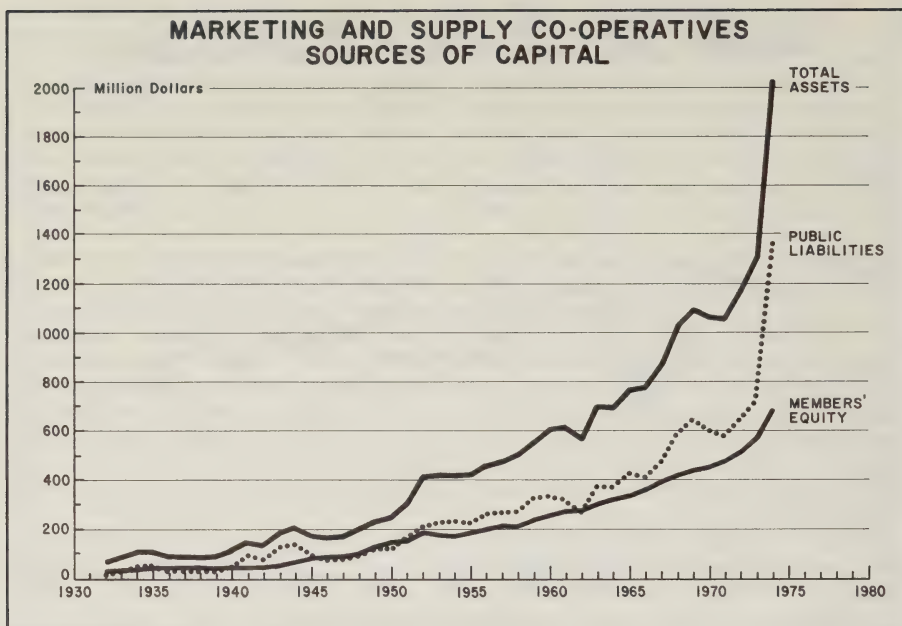


Figure 3

equity growth bears no relation to the short-term needs of the business and cannot be stepped up to help the immediate financial needs of the co-operatives. By contrast, the public liabilities mirror the total capital requirements of the businesses and show how dependent the co-operatives are on their ability to borrow money, particularly from normal banking sources.

What the limit of such borrowings may be can only be conjecture. At what point lending institutions might decide that their share of the capital input was too great, one does not know. What can be said is that there is no evidence so far that the growth of Canadian co-operatives has been retarded, unlike the situation in other countries where, in effect, co-operatives have restricted growth to allow the share of members' equity

to "catch up" with the inflationary situation. This is a great credit to the reputation and financial stability of Canadian marketing and purchasing co-operatives.

## SUMMARY

The business volume of marketing and supply co-operatives reached a record \$4.8 million in 1974. Although much of the 40-percent increase above 1973 was due to high commodity prices and general inflation, co-operatives continued to increase their share of the market for most products. The data suggest that they did not encounter serious problems in financing this increased business, although there was a greater reliance than normal on outside sources of finance to provide the necessary capital.

# TRENDS IN PRODUCTION OF FORAGE CROPS IN CANADA



J.S. Carmichael \*

*The cattle industry in Canada is beginning to rely increasingly on forage crops. Forages make up a high proportion of the feed consumed by livestock, providing about 70 percent of the feed for cattle.*

*With changing costs and returns affecting efficiencies of different crops, changes are occurring in the mix of forage crops in different areas, an example being the growing preference for silage corn in relation to hay.*

## INTRODUCTION

The importance of forages in Canada is growing steadily as livestock populations increase. Forage crops and pasture provide the bulk of livestock diets and have received greater attention since the advent of higher grain prices in 1972. Over the years forage crop development has varied among regions, reflecting the natural production advantages of the individual regions as well as their over-all ability to provide basic feeds for livestock. Since the cost of forages increases in proportion to distances transported, proximity to forage supplies is a significant factor in the location of livestock enterprises.

The main forage crops in Canada are silage corn, tame and other hay, including clover and alfalfa, and oats and other grain harvested for forage, usually as green feed. Others include haylage, straw, corn stover, millet, sudan grass, sudan-sorghum and other varieties of plants suitable for green chop or silage. However, the importance of forage crops in relation to other crops is difficult to show. Although Statistics Canada estimates production of the main forage crops, domestic sales are

usually on a farm-to-farm basis with no centralized trading so that prices are not available except occasionally for specific products in particular areas. Estimating the total farm value of forage crops is difficult and of questionable quality. The estimated farm value of hay and forage crops, particularly in past years when sales data were even less available than at present, probably does not adequately show their value to the agriculture sector as inputs into the livestock industry.

Between 1941 and 1971 census data indicate forage crop acreage increased by 3.25 million acres (30 percent) to 15 million acres (Table 1). With substantial yield increases forage crop production nearly doubled over the period. Of total acreage in 1971, some 82 percent was in tame hay, 9 percent in oats, 5 percent in silage corn and 3 percent in "other" crops. More recently hay and fodder corn acreage increased, but in 1975 total fodder acreage and production were a little lower than in 1974.

The cattle population also increased between 1941 and 1971, from 8.5 million to 13.3 million (Table 2). It increased more steadily than forage crop acreage and continued to increase in 1975. A declining sheep industry still numbers about 500,000 head compared with 2.8 million in 1941. Statistics Canada no longer estimates horse numbers but there were about 340,000 on farms in 1973 compared with 2.8 million in 1941.

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**TABLE 1. FORAGE CROP ACREAGES IN CANADA, CENSUS YEARS**

| Year | Forage<br>Crop<br>Acreage | Percentage of Total Forage Acreage |                |                    |       |
|------|---------------------------|------------------------------------|----------------|--------------------|-------|
|      |                           | Tame<br>Hay                        | Fodder<br>Oats | Corn for<br>Silage | Other |
|      | — '000 acres —            |                                    |                | — percent —        |       |
| 1941 | 11,751                    | 86.3                               | 8.6            | 3.7                | 1.4   |
| 1951 | 11,384                    | 86.3                               | 8.5            | 3.5                | 1.7   |
| 1956 | 12,349                    | n.a.                               | n.a.           | n.a.               | n.a.  |
| 1961 | 14,196                    | 86.2                               | 8.6            | 2.9                | 2.3   |
| 1966 | 15,435                    | 85.3                               | 7.9            | 3.8                | 3.0   |
| 1971 | 15,015                    | 82.3                               | 9.3            | 5.3                | 3.1   |

Source: Census of Canada, 1971 (Cat. No. 96-701)

**TABLE 2. CATTLE NUMBERS ON FARMS AT JUNE 1, SELECTED YEARS**

| Year | Prince<br>Edward<br>Island | Nova<br>Scotia | New<br>Brunswick | Quebec  | Ontario | Manitoba | Saskatchewan | Alberta | British<br>Columbia | Canada   |
|------|----------------------------|----------------|------------------|---------|---------|----------|--------------|---------|---------------------|----------|
|      | — thousand head —          |                |                  |         |         |          |              |         |                     |          |
| 1941 | 94.4                       | 204.9          | 207.0            | 1,757.3 | 2,539.5 | 705.3    | 1,241.2      | 1,342.1 | 325.5               | 8,517.2  |
| 1951 | 98.0                       | 166.2          | 161.9            | 1,640.8 | 2,465.9 | 671.2    | 1,274.8      | 1,563.0 | 321.3               | 8,363.1  |
| 1961 | 121.1                      | 163.7          | 160.2            | 1,915.2 | 3,115.7 | 995.6    | 2,121.1      | 2,879.4 | 461.8               | 11,933.8 |
| 1966 | 125.2                      | 147.6          | 136.5            | 1,797.6 | 3,137.0 | 1,151.2  | 2,398.0      | 3,439.7 | 546.0               | 12,878.8 |
| 1971 | 106.1                      | 130.9          | 112.7            | 1,780.8 | 3,082.0 | 1,138.1  | 2,645.0      | 3,702.1 | 573.2               | 13,270.9 |
| 1972 | 103.0                      | 130.0          | 110.0            | 1,776.0 | 3,116.5 | 1,176.0  | 2,770.0      | 3,881.0 | 594.0               | 13,656.5 |
| 1973 | 98.0                       | 131.0          | 107.0            | 1,830.0 | 3,168.5 | 1,196.0  | 2,852.0      | 4,133.0 | 618.0               | 14,133.5 |
| 1974 | 104.4                      | 135.0          | 113.6            | 1,920.0 | 3,206.0 | 1,291.0  | 3,027.0      | 4,479.0 | 672.0               | 14,948.0 |
| 1975 | 106.0                      | 145.0          | 116.0            | 1,939.0 | 3,141.0 | 1,339.0  | 3,156.0      | 4,553.0 | 725.0               | 15,260.0 |

Source: Handbook of Agricultural Statistics, Part 6 — Livestock and Livestock Products, Statistics Canada, to 1973. Data for 1974 and 1975 from Statistics Canada but not yet published.

Cattle, over a period of years, have assumed a dominant role as forage consumers.

of improved pasture and 37 million acres of unimproved pasture in Canada.

In addition to stored forage crops to feed the increasing cattle population, aftermaths of clover, alfalfa and grasses provide some of the best pasture. Such aftermaths are important to both the beef and dairy industries, complementing the estimated 10 million acres

## TAME HAY

Tame hay (including alfalfa, clovers, etc.) is the largest group of Canadian forage crops and since 1941 the area has increased from 10.4 to 13 million acres (Table 3).

**TABLE 3. TAME HAY IN CANADA: ESTIMATED ACREAGE, PRODUCTION, FARM PRICE AND VALUE**

| Year | Acreage        | Average<br>yield<br>per acre | Total<br>Production | Average<br>farm<br>price | Total<br>farm<br>value |
|------|----------------|------------------------------|---------------------|--------------------------|------------------------|
|      | — '000 acres — | — tons —                     | — '000 tons —       | — \$ per ton —           | — \$ '000 —            |
| 1941 | 10,365         | 1.39                         | 14,448              | 12.36                    | 178,638                |
| 1951 | 10,538         | 1.92                         | 20,190              | 15.21                    | 307,118                |
| 1961 | 12,229         | 1.70                         | 20,812              | 15.63                    | 325,327                |
| 1966 | 13,154         | 1.98                         | 26,049              | 18.02                    | 469,284                |
| 1971 | 12,053         | 2.01                         | 24,182              | 20.01                    | 483,811                |
| 1972 | 12,459         | 1.86                         | 23,229              | 23.14                    | 537,446                |
| 1973 | 12,850         | 2.00                         | 25,748              | 29.04                    | 747,838                |
| 1974 | 13,033         | 1.95                         | 25,402              |                          |                        |
| 1975 | 13,014         | 1.99                         | 25,933              |                          |                        |

Source: Field Crop Reporting Series and Quarterly Bulletin of Agricultural Statistics, Statistics Canada (Cat. Nos. 22-002 and 21-003).

Yields during the past 10 years have averaged about 2 tons per acre, although they often vary greatly among areas and crop species. Production was about 26 million tons in 1975, 80 percent greater than in 1941.

For the most part there are no markets with regularly quoted prices. Prices often reflect hay shortages caused by drought or other weather problems. Some small areas of Canada are not normally fully self-sufficient, such as the Fraser Valley and Vancouver Island, which have to import some supplies from the United States and Alberta. The average farm price for hay in British Columbia is normally 30-40 percent above the Canadian average. Prices throughout Canada have been very volatile in the last two years. In Ontario, prices in late 1975 and early 1976 have been reported at \$60-\$90 a ton and in some parts of eastern Canada they rose as high as \$100 a ton. In early 1975, Alberta farmers were reportedly receiving \$16-\$22 a ton dry weight basis for alfalfa standing in the field, with irrigated alfalfa for dehydration running at \$25-\$30 a ton. The quality of hay offered for sale varies greatly, particularly in central Canada and the Maritimes; in the latter more than one third of the hay tested in the past three years was rated poor.

The estimated value of tame hay grown in Canada in 1973, the last year for which estimates have been prepared, was about \$750 million, putting it among the most valuable field crops grown in Canada. For the same year the estimated value of wheat was \$2.6 billion, barley \$1.2 billion, oats \$515 million, rapeseed \$304 million and rye \$36 million.

## Regional Trends in Tame Hay Production

Considerable regional variation has occurred in acreage of tame hay (Table 4). The principal feature is the large relative growth in the prairie region and British Columbia, and the relative decline in central Canada and the Maritimes. Highest average yields were in Ontario and British Columbia where they have exceeded 2.5 tons. In Quebec and the Maritimes yields have reached 2 tons in average years and in the Prairie Provinces on six occasions in 15 years yields have reached or surpassed 1.7 tons. On irrigated areas in the prairie region, yields would probably be double dryland yields. In terms of production in 1975 the prairie region had 45 percent of the total, Ontario 25 percent, Quebec 20 percent, the Maritimes about 3.5 percent and British Columbia nearly 7 percent.

## SILAGE CORN

### Canadian Trend

Silage corn acreage in Canada was 407,100 acres in 1941, fell to 360,100 in 1961 and then started a steady climb at a much faster rate than tame hay (Table 5). In 1974, silage corn acreage exceeded 1 million acres, although some of the increase that year was due to frost affecting corn intended for grain. Average yields have increased about 45 percent since 1971 to a record high in 1975. Canadian production has almost tripled since 1941.

The average farm price for silage corn is particularly difficult to estimate since it is normally consumed on the farms of origin. The average farm price between 1941 and 1973 is estimated to have nearly tripled and

**TABLE 4. ACREAGE OF TAME HAY BY REGION IN CANADA**

| Year | Tame Hay<br>Acreage | Percentage of Tame Hay Acreage by Region |        |         |             |                     |
|------|---------------------|--|--------|---------|-------------|---------------------|
|      |                     | Maritimes                                | Quebec | Ontario | Prairies    | British<br>Columbia |
|      | — '000 acres —      |  |        |         | — percent — |                     |
| 1941 | 10,365              | 11.5                                     | 36.2   | 35.8    | 14.0        | 2.5                 |
| 1951 | 10,538              | 9.8                                      | 34.7   | 32.3    | 20.6        | 3.0                 |
| 1961 | 12,229              | 5.7                                      | 27.1   | 26.8    | 37.1        | 3.3                 |
| 1966 | 13,154              | 4.9                                      | 27.1   | 26.8    | 37.1        | 3.3                 |
| 1971 | 12,053              | 3.6                                      | 22.4   | 22.5    | 47.2        | 4.3                 |
| 1972 | 12,459              | 3.5                                      | 21.3   | 21.7    | 49.0        | 4.5                 |
| 1973 | 12,850              | 3.5                                      | 20.8   | 22.2    | 49.0        | 4.5                 |
| 1974 | 13,033              | 3.3                                      | 20.5   | 20.7    | 50.7        | 4.8                 |
| 1975 | 13,014              | 3.4                                      | 20.7   | 20.7    | 50.4        | 4.8                 |

Source: Field Crop Reporting Series, Statistics Canada

**TABLE 5. CORN FOR FODDER IN CANADA: ESTIMATED ACREAGE, PRODUCTION, FARM PRICE AND VALUE**

| Year | Acreage        | Average<br>yield<br>per acre | Total<br>Production | Average<br>farm<br>price | Total<br>farm<br>value |
|------|----------------|------------------------------|---------------------|--------------------------|------------------------|
|      | — '000 acres — | — tons —                     | — '000 tons —       | — \$ per ton —           | — \$'000 —             |
| 1941 | 407,100        | 9.29                         | 3,783               | 3.78                     | 14,293                 |
| 1951 | 385,600        | 9.49                         | 3,661               | 4.99                     | 18,271                 |
| 1961 | 360,100        | 11.26                        | 4,054               | 5.41                     | 21,949                 |
| 1966 | 577,700        | 11.50                        | 6,643               | 6.68                     | 44,404                 |
| 1971 | 771,600        | 13.55                        | 10,458              | 6.89                     | 72,064                 |
| 1972 | 812,200        | 12.36                        | 10,042              | 7.88                     | 79,129                 |
| 1973 | 892,500        | 12.63                        | 11,276              | 10.51                    | 118,516                |
| 1974 | 1,048,000      | 10.56                        | 11,070              |                          |                        |
| 1975 | 971,000        | 13.60                        | 13,202              |                          |                        |

Source: Field Crop Reporting Series and Quarterly Bulletin of Agricultural Statistics, Statistics Canada

**TABLE 6. ACREAGE OF CORN FOR FODDER BY REGION IN CANADA**

| Year | Fodder Corn<br>Acreage | Percentage of Fodder Corn Acreage by Region |        |             |          | British<br>Columbia |
|------|------------------------|---|--------|-------------|----------|---------------------|
|      |                        | Maritimes <sup>a</sup>                      | Quebec | Ontario     | Prairies |                     |
|      | — '000 acres —         |   |        | — percent — |          |                     |
| 1941 | 407                    | —   | 14.7   | 72.5        | 11.7     | 1.1                 |
| 1951 | 386                    | —   | 20.8   | 73.1        | 5.1      | 1.0                 |
| 1961 | 360                    | —   | 15.2   | 74.7        | 9.2      | 0.9                 |
| 1966 | 637                    | —   | 12.8   | 78.6        | 7.5      | 1.1                 |
| 1971 | 76                     | —   | 17.0   | 79.8        | 1.5      | 1.7                 |
| 1972 | 812                    | —   | 17.4   | 78.3        | 2.7      | 1.6                 |
| 1973 | 892                    | —   | 17.0   | 78.5        | 2.7      | 1.8                 |
| 1974 | 1,048                  | —   | 15.5   | 80.1        | 2.7      | 1.7                 |
| 1975 | 971                    | —   | 19.6   | 75.2        | 3.4      | 1.8                 |

<sup>a</sup>Maritime acreages were not estimated by Statistics Canada.

Source: Field Crop Reporting Series, Statistics Canada

total value to have increased more than 8 times to \$118 million.

### Regional Trends

Ontario dominates Canadian production with 75 to 80 percent of the total (Table 6). Quebec ranks second with 15 to 20 percent and relatively small acreages exist elsewhere, although with some increases in recent years in Manitoba and British Columbia. While the Maritimes are not included in the Statistics Canada survey, acreage has been increasing there again with 12,000 acres in Nova Scotia in 1974. Yields in 1975 averaged 20 tons per acre in British Columbia, 14 tons in Quebec, 13.5 tons in Ontario and 8.8 tons in Manitoba. In Manitoba 1975 was the first year yields exceeded 8 tons. In terms of total production (excluding the Maritimes) in 1975, Ontario had 74.7 percent, Quebec 20.4 percent, the Prairies 2.2 percent and British Columbia 2.7 percent.

### OATS FOR FORAGE

Oats harvested as green feed is an important source of forage for cattle particularly in western Canada (Table 7). Acreage in Canada increased from 1 million acres in 1941 to 1.4 million in 1971<sup>1</sup>. Some 80 percent is in the prairies and the bulk of the remainder in Quebec. There are no official estimates of production or farm value. With an acreage about one tenth that of hay, the value might be considered about \$75 million in 1973, one tenth the value of that year's hay crop.

### OTHER FORAGE CROPS

Besides oats, there are various other forage crops for which production estimates are available also only in

<sup>1</sup>Production of oats outside the prairie area is estimated only in census years.

**TABLE 7. ACREAGE OF OATS FOR FODDER, CANADA, CENSUS YEARS**

| Year | Total<br>Acreage of Oats<br>for fodder<br>— '000 acres — | Percentage of Oats for Fodder Acreage by Region |        |             |          |                     |
|------|--|---|--------|-------------|----------|---------------------|
|      |  | Maritimes                                       | Quebec | Ontario     | Prairies | British<br>Columbia |
|      |  |   |        | — percent — |          |                     |
| 1941 | 1,015  | 1.8   | 4.3    | 3.4         | 87.2     | 3.3                 |
| 1951 | 967  | 2.4   | 11.6   | 4.4         | 78.3     | 3.3                 |
| 1961 | 1,222  | 1.3   | 9.6    | 3.2         | 82.9     | 3.0                 |
| 1966 | 1,218  | 1.2   | 17.2   | 5.0         | 73.5     | 3.1                 |
| 1971 | 1,402  | 0.8   | 13.5   | 2.8         | 80.0     | 2.9                 |

Source: Census of Canada, 1971 (Cat. No. 96-701)

**TABLE 8. ACREAGE OF OTHER FORAGE CROPS, CENSUS YEARS**

| Year | Total Acreage<br>Other<br>Forage Crops<br>— '000 acres — | Percentage of Acreage of Other Forage Crops by Region |        |             |          |                     |
|------|--|---|--------|-------------|----------|---------------------|
|      |  | Maritimes   | Quebec | Ontario     | Prairies | British<br>Columbia |
|      |  |   |        | — percent — |          |                     |
| 1941 | 158.4  | 1.1   | 8.5    | 10.8        | 74.6     | 5.0                 |
| 1951 | 187.6  | 0.9   | 6.1    | 5.4         | 84.2     | 3.4                 |
| 1961 | 368.5  | 1.0   | 13.7   | 7.3         | 72.0     | 6.0                 |
| 1966 | 463.9  | 2.0   | 21.4   | 11.9        | 60.4     | 4.3                 |
| 1971 | 461.7  | 1.3   | 16.6   | 7.3         | 69.7     | 5.1                 |

Source: Census of Canada, 1971 (Cat. No. 96-701)

census years (Table 8). Contained in this group are barley, rye and rapeseed, harvested like oats and stored for forage. Combined acreage of these has tended to be about one third that in oats, and the farm value in 1973 may have been about \$25 million. Two thirds or more of total production has been in the prairies.

## STRAW AND CORN STOVER

In addition to the forage crops reported by Statistics Canada there are two other significant types, straw and corn stover, which are by-products of grain production. The quantity of straw produced, according to Dr. Ewen Coxworth, Saskatchewan Research Council, Saskatoon, tends to be about 1 pound per pound of grain, suggesting the wheat, oats, barley and rye grown in Saskatchewan in 1975 produced about 35 million tons of straw.

## REGIONAL TRENDS IN FORAGE CROP DEVELOPMENTS AND CATTLE NUMBERS

While there are many reasons for the expansion or contraction that has occurred in different regions in Canada in the cattle industry, one factor has been the availability of adequate supplies of forage crops that can be economically used as inputs.

The main increase in cattle populations since 1961 has been on the prairies, with hay providing most of the additional forage required (Table 2). In Alberta where cattle populations increased 58 percent between 1961 and 1975 to more than 4.5 million, hay production increased from about 3.2 million tons (1960) to 6.1 million in 1974 (but fell to 5.8 million in 1975). In Saskatchewan by 1975 the cattle population had increased 43 percent to 3.2 million; hay production increased from about 1.6 million tons (1960) to 3.4 million in 1975. The Manitoba cattle population increased 30 percent to 1.3 million and hay production from 1.6 million tons (1960) to 2.5 million in 1975.

Apart from the Prairie Provinces the only other area with strong gains on a percentage basis in cattle numbers from 1961 to 1975 was British Columbia, where cattle numbers increased 57 percent to 725 thousand. Tonnage of tame hay and silage corn more than doubled, with silage corn increasing its share from 5 percent to more than 17 percent of the combined tonnage.

In Quebec cattle numbers in 1975 at 1.9 million were little different from 1961, but were lower in most intervening years. Combined tonnage of silage corn and hay was 20 percent higher than in 1961 but hay tonnage

**TABLE 9. EXPORTS AND IMPORTS OF HAY AND CLOVER, FORAGE AND STRAW, CANADA 1966-75**

|      | Exports hay and<br>clover, forage & straw <sup>a</sup> |                   | Imports hay,<br>forage & straw |                   |
|------|--|-------------------|--------------------------------|-------------------|
|      | — '000 tons —  | — value (\$000) — | — '000 tons —                  | — value (\$000) — |
| 1966 | 60   | 1,435             | 42                             | 1,202             |
| 1967 | 71   | 1,254             | 38                             | 1,066             |
| 1968 | 74   | 1,228             | 49                             | 1,396             |
| 1969 | 112  | 1,850             | 66                             | 2,254             |
| 1970 | 162  | 2,998             | 69                             | 2,216             |
| 1971 | 144  | 3,271             | 71                             | 2,531             |
| 1972 | 134  | 3,169             | 90                             | 3,518             |
| 1973 | 167  | 4,440             | 103                            | 5,142             |
| 1974 | 121  | 3,477             | 127                            | 8,666             |
| 1975 | 74   | 3,892             | 171                            | 11,356            |

<sup>a</sup>Statistics Canada Classification

Source: Imports by Commodities, Exports by Commodities, Statistics Canada.

was down 14 percent to 52 million tons while silage corn increased more than four times to 2.7 million tons, providing one third of the tonnage of the two crops combined.

The pattern in Ontario is similar to that in Quebec. Livestock numbers changed little from 1961 to 1975 when they reached 3.1 million head. Combined tonnage of hay and silage corn was up about 50 percent at 16.3 million tons with hay down more than 20 percent at 6.5 million tons. Corn silage production tripled to 7.9 million tons, well above hay tonnage.

In the Maritime Provinces cattle numbers fell 17 percent to 367 thousand between 1961 and 1975. Hay production decreased more than 40 percent to 823 thousand tons.

## INTERNATIONAL TRADE

International trade is a very minor aspect of forage crops (Table 9). In 1974 Canadian exports of dehydrated alfalfa amounted to almost 77,000 tons valued at \$6.6 million and hay, clover, forage and straw exports at 121,000 tons were worth \$3.5 million<sup>2</sup>. In 1975 dehydrated alfalfa exports amounted to 88,000 tons valued at \$7.1 million. Prices for Canadian exports for 1975 averaged \$80 per ton compared with \$86.70 in 1974. Hay, clover, forage and straw exports of 74,000 tons were valued at \$3.9 million. Imports have been increasing. In 1974 imports of hay, forage and straw amounted to nearly 127 thousand tons valued at \$8.7 million. In 1975, imports of 171 thousand tons were

valued at \$11.4 million. Exports equal about 1 percent of the total value of all tame hay produced in Canada.

## FORAGE CROPS AND SECONDARY INDUSTRY

The honey industry depends on some forage crops such as clovers and alfalfa. Production of forage seed is also an important source of farm income. The only significant value-added processing-type activity occurs in the case of alfalfa.

Of considerable significance in the alfalfa industry in Western Canada has been the growth in cubing and pelleting, the principal type of industrial development among forage crops. The increase in recent years has been in pellets, which constitute about 85 percent of total dehydrated production. There are no forage processing plants in the Maritimes but 11 between Ontario and Quebec. It is reported (Cross Canada Report, March 8, 1976) there are 33 processing plants in western Canada with an approximate rated capacity of 465,000 tons annually. Actual capacity of many plants, however, depends on the initial moisture content of the alfalfa. The main development has been on the prairies with Alberta the leading producer in 1975 although Saskatchewan plants started increasing first and are operating closer to capacity. In 1976 there will be 14 processing facilities in Alberta plus two portable cubers with a theoretical capacity of 225,000 tons of semi-cured and dehydrated pellets and cubes. There are 19 permanent drying drums in operation at the 14 sites. Approximately 98,000 acres of alfalfa in Alberta are slated for processing in 1976. Total production of processed alfalfa in Alberta for the current crop year is estimated at 107 thousand tons compared with 89 thousand in 1974-75.

<sup>2</sup> 1974 was the first year in which Statistics Canada listed alfalfa exports as a separate item.

In recent years about 40 percent of the production in Saskatchewan and Alberta has been exported. However, about 80 percent of the alfalfa processed in Alberta in 1975 was utilized in the domestic market and 20 percent exported. Almost all exports in 1975 went to Japan with several small lots to the European Economic Community.

Prices of alfalfa products at U.S. points in mid-May 1976 were 15-20 percent above 1975. Alfalfa Centre pellets were \$78 per ton compared with \$65. Kansas City sun-cured alfalfa pellets were \$83 compared with about \$70.

### Factors Affecting Prospects for Forage Crops

Costs and returns to the livestock, feed grain and forage crop industries affect one another and will continue to do so.

In the June 1976 livestock survey it is expected cattle numbers will be down 5 percent with no recovery likely on July 1, 1977. This should have an impact on forage crop prices and eventually on quantities of forage required.

### Silage Corn

The expansion of silage corn production is likely to depend on the changing size of the livestock industry as well as the ability of silage corn to provide forage in competition with other sources such as hay. It will depend too on the development of corn varieties suitable for growing in areas where corn cannot be grown now because of short growing seasons.

An analysis made by Gary R. Buck, dairy specialist, Ontario Ministry of Agriculture and Food, suggests that with hay at \$77 per ton and soybean meal at \$175 per ton, silage corn on the basis of nutritional value would be worth \$28.75 per ton<sup>3</sup>. Under these circumstances an acre of hay in Ontario averaging 2.5 tons would have a farm value of \$192.50, and an acre of silage corn at 12 tons would have a farm value of \$345. Even with higher costs of production for corn it would appear there should be a substantial advantage in Ontario, Quebec and British Columbia in growing corn where soil, climate and available varieties permit. The future of corn for silage on the prairies and in the Maritimes is less predictable, although with newer varieties, modest

increases have recently been attained and studies and tests are being carried out in each area. Some continued expansion in favorable parts of each area seems likely.

### Tame Hay

Major increases in tame hay production are unlikely in the near future because of several factors, including lower cattle populations, better returns for silage in Ontario and Quebec particularly and problems in maintaining quality of hay. The level of production in the prairie region will remain high though will probably level off or fall back at least temporarily with lower cattle numbers and possibly some renewed emphasis on grain feeding.

Some factors favor continuing expansion of the alfalfa industry but some problems exist. The high cost of investment and increasing costs of natural gas, electricity and labor have an impact on the cost of dehydrating alfalfa. While no particular analysis is attempted here, returns to farmers growing alfalfa for processing do not appear to have been as good in the last year or so as returns to grain farmers. There are some offsetting advantages to feeders in haulage savings, less waste, savings in storage space and ability to feed mechanically. Use of dehydrated products has gained acceptance by some feeders and farmers. However, in assessing the role of alfalfa or any forage crop, consideration needs to be given to its desirable role in rotation, especially in the grey-black and grey soils in the northern part of the western provinces. When legume forage crops are included in rotations in these areas, increased grain yields are obtained. This is an important reason why the alfalfa processing industry became established. This would suggest that further expansion of the alfalfa processing industry may be in competition with feed grains rather than wheat.

Another potential for alfalfa is for commercial leaf protein extraction. Work is progressing on the technology required but it is expected to take about 10 years before extraction on a commercial basis will occur. Alfalfa contains 2-2.5 percent white protein that could be used in breads, pastas, soups, stews, etc., and 5 percent green protein suitable for use in animal feeds.

### Oats Cut for Forage and Other Forage Crops

The acreage in oats cut for forage appears to have some relationship to total acreage in oats, but changes in acreage do not indicate any particular pattern. As feed grain supplies were building up and prices were low, as in 1971, the quantities of oats or barley harvested for

<sup>3</sup> Eastern Ontario Soil and Crop Improvement Association, Crop Day, Kemptville, Ontario, January 20, 1975.

forage were relatively high. Feed grain prices increased rapidly in 1973 and the area cut for green feed decreased. The 1974 harvesting season was very late and the area of oats and barley harvested for forage increased. In 1975, with a better season and fairly good price prospects for grain, the harvested area of these crops was sharply reduced. In general the quantity of such crops harvested as forage is a function of the area planted to grains that is suitable for fodder if weather conditions are unfavorable for grain production or grain prices are low.

### **Straw and Corn Stover**

A great deal of research is being conducted on both straw and corn stover and is particularly relevant at this time with relatively high grain and hay prices. According to C.C. Morrow of Perth, Ontario, straw has a crude protein range of 3.2-4 percent compared with 7.3-17 percent for hay<sup>4</sup>. Corn stover may average about 4.5 percent protein. Digestibility of protein is low with both forages. The TDN content of straw, however, tends to be about 40 percent, with hay usually over 50 percent and

corn stover varying widely from 16 to 51 percent. Oat straw has the highest TDN content among grains.

Straw can be fed to wintering beef cows, supplemented with protein, vitamin A and mineral, but must be top quality by baling directly on harvest. This aspect would present scheduling problems in some areas such as the prairies. Acceptability of straw by cattle improves when ground and mixed with hay or grain. Corn stover can be used by pasturing, harvesting dry corn stalks or ensiling. These two forages have often been wasted in the past but increased utilization can be expected with current price levels for other feeds.

### **SUMMARY**

Forages make up a high proportion of the feed consumed by farm animals, providing about 70 percent of the feed consumed by cattle. The cattle industry in Canada developed on cheap grain, but is now beginning to rely more and more on forage crops. With changing costs and returns affecting efficiencies of different crops, changes are occurring in the mix of forage crops in different areas. The increasing use of corn for silage at the expense of hay is an example. Finally, better use of straw and other products formerly regarded as wastes may become significant in future forage crop development.

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<sup>4</sup>Eastern Ontario Soil and Crop Improvement Association, Crop Day, Kemptville, Ontario, January 20, 1975

# RETAIL GROCERY PRICE VARIATION IN SASKATCHEWAN\*



D.L. Maley\*\*

*Small differences in food prices were found between urban and rural centres in Saskatchewan. The food basket price was influenced by the size and location of the store. Fruits and vegetables as a group showed the greatest variations. Food basket prices did not necessarily increase as one moved farther away from a city.*

## INTRODUCTION

Frequent comparisons are made of food prices and the cost of living among urban centres in Canada, but few studies have examined differences in the cost of living between urban and rural centres. Since food costs are a major component of the cost of living<sup>1</sup>, it is important that data be available to show differences in food prices between urban and rural centres and that there be analyses to explain such differences.

\*The data used in this article are from an M.Sc thesis prepared by the author at the University of Saskatchewan, Saskatoon, November 1975. The thesis was funded by Agriculture Canada, the Saskatchewan Department of Agriculture, and the University of Saskatchewan.

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<sup>1</sup>The breakdown of the 70 percent of total income for necessities is as follows: 27 percent for food; 32 percent for housing; and 11 percent for clothing. (Canada Year Book, 1973, p. 862).

This article reports the results of a study comparing urban and rural food prices in Saskatchewan. The two objectives of the study were to measure spatial food price differentials by comparing the cost of a food basket between urban and rural centres and to determine the factors causing the price differentials.

The article discusses the data collection and the calculation of the food basket price. This is followed by an analysis of the food basket prices for the various centres and stores surveyed. The explanations of price variations are presented in the regression results section. The article concludes with recommendations for further work in this area.

## DATA

Data were obtained through a survey questionnaire. The sampled stores ranged in size from 500 to 15,000 square feet in centres with populations ranging from 30 to 140,000. The centres were picked from concentric circles, with radii of 10, 25, 50 and 100 miles, around six major cities — Regina, Saskatoon, Prince Albert, North Battleford, Yorkton and Swift Current. Within

**TABLE 1. 1969 WEEKLY CONSUMPTION AND EXPENDITURE OF FOOD BASKET ITEMS FOR AN AVERAGE SASKATCHEWAN FARM FAMILY OF 4.25 MEMBERS AND THE INDEXES OF IMPORTANCE FOR FOOD BASKET ITEMS**

| Items in Basket      | Weekly 1969 Quantity Consumed | Weekly 1969 Expenditure \$ | Index of Importance of Items in the Basket Based on 1969 Data |
|----------------------|-------------------------------|----------------------------|---|
| Milk — Homogenized   | 6.79 qt.                      | 2.05                       | 17.9  |
| Milk — 2%            | .72 qt.                       | .20                        | 1.7   |
| Butter               | 1.07 lbs.                     | .76                        | 6.6   |
| Grade A Eggs — Large | .14 doz.                      | .07                        | 0.6   |
| Grade A Eggs — Small | .14 doz.                      | .05                        | 0.4   |
| Margarine            | 1.08 lbs.                     | .36                        | 3.1   |
| Processed Cheese     | .04 lbs.                      | .13                        | 1.1   |
| Powdered Skim Milk   | .03 lbs.                      | .11                        | 1.0   |
| Sirloin Steak        | .07 lbs.                      | .08                        | 0.7   |
| Round Steak          | .11 lbs.                      | .09                        | 0.8   |
| Prime Rib Roast      | .08 lbs.                      | .08                        | 0.7   |
| Ground Beef          | .40 lbs.                      | .27                        | 2.4   |
| Bacon                | .29 lbs.                      | .26                        | 2.3   |
| Cooked Ham           | .35 lbs.                      | .04                        | 0.4   |
| Loin Pork Chop       | .15 lbs.                      | .15                        | 1.3   |
| Sausage — Pork       | .32 lbs.                      | .21                        | 1.8   |
| Weiners              | .67 lbs.                      | .40                        | 3.5   |
| Bologna              | .57 lbs.                      | .28                        | 2.4   |
| Chicken — frozen     | .07 lbs.                      | .32                        | 2.8   |
| Chicken — fresh      | .07 lbs.                      | .32                        | 2.8   |
| Salmon — red         | .31 lbs.                      | .07                        | 0.6   |
| Salmon — pink        | .33 lbs.                      | .07                        | 0.6   |
| Oranges              | .48 lbs.                      | .28                        | 2.4   |
| MacIntosh Apples     | 1.18 lbs.                     | .26                        | 2.3   |
| Bananas              | 1.39 lbs.                     | .26                        | 2.3   |
| Potatoes             | 26.9 lbs.                     | .96                        | 8.4   |
| Tomatoes             | .36 lbs.                      | .11                        | 1.0   |
| Bread                | 4.18 lbs.                     | .83                        | 7.2   |
| Spaghetti            | .04 lbs.                      | .02                        | 0.2   |
| Long Grain Rice      | .02 lbs.                      | .01                        | 0.1   |
| Short Grain Rice     | .02 lbs.                      | .01                        | 0.1   |
| Coffee — Instant     | .13 lbs.                      | .14                        | 1.2   |
| Coffee — Reg. Grind  | .32 lbs.                      | .28                        | 2.4   |
| Sugar                | 4.8 lbs.                      | .59                        | 5.1   |
| Flour                | 8.9 lbs.                      | .78                        | 6.9   |
| Corn Flakes          | .24 lbs.                      | .14                        | 1.2   |
| Tomato Soup          | 1.09 lbs.                     | .13                        | 1.1   |
| Apple Juice          | .60 lbs.                      | .09                        | 0.8   |
| Fruit Cocktail       | .16 lbs.                      | .04                        | 0.4   |
| Brown Beans          | .94 lbs.                      | .16                        | 1.4   |
| Total                |                               | \$11.47                    | 100.0   |

Source: Statistics Canada, Family Food Consumption and Expenditure for Saskatchewan, 1969.

each circle, centres with populations of 500, 501-1,000, 1,001-2,500, and 2,501-5,000 were selected. There were 183 stores surveyed in 85 centres.

## DETERMINATION OF FOOD BASKET PRICE

A food basket of 40 items was assembled to compare prices of food items in different centres and stores. Since

1974 consumption and expenditure data for the food items were unavailable, the study used 1969 Statistics Canada consumption and expenditure data for an average farm family of 4.25 members. Statistics Canada estimated that in 1969 this average family spent \$11.47 per week for the 40 items (Table 1). The study employed a method of weighting the importance of food items based on the 1969 data by dividing the expendi-

ture of each item by the total expenditure of all items to give what is called an index of importance for each item. For example, the calculation of the index of importance of homogenized milk is as follows:

$$\text{Index} = \frac{2.05}{11.47} = 17.9$$

These indexes are shown in Table 1.

When a store carried an item contained in the basket, the average price of all brands carried by the store for that item was multiplied by the quantity consumed in 1969, giving the 1974 price.<sup>2</sup> At the same time, the index of importance of the item was recorded. The index indicates the importance of the item in the consumption patterns of the average farm family. Thus, stores that did not carry a large number of the items in the food basket that were important to the average family would have to be omitted from the sample. It was decided that if a store carried less than 75 percent of the indexed items, it was excluded from the sample. This reduced the number of stores in the analysis from 183 to 150 and the number of centres from 85 to 74. If a store carried 75 percent or more of the indexed items, its mark-up on the items not recorded was assumed to be the same as on the recorded items.

For each store, the food basket price was calculated as follows: first, the food basket items available in the store were noted. Second, the total cost of these items was determined. Third, this cost was multiplied by 100 and divided by the sum of the indexes of importance. The calculation can be shown as:

$$\text{Store Price for Food Basket} = \frac{\text{Cost of Items Available} \times 100}{\text{Sum of Indexes of Importance}}$$

This price became the basis for measuring price variations between centres and was the dependent variable for explaining the price variations in terms of selected independent variables.

Since stores changed prices only once a week, but many stores changed prices each week, it was essential for the survey to be conducted within a one-week period. It was done during the week of June 17-22, 1974.

<sup>2</sup> This assumes there was no change in the consumption patterns of the average Saskatchewan farm family from 1969 to 1974.

## ANALYSIS OF FOOD BASKET PRICES

### Food Price Differentials in Saskatchewan

Veregin, a community northeast of Yorkton with a population of 197, had the lowest food basket price of all centres, at \$18.60, or 81.1 percent of the average price of all stores in Saskatchewan, which was \$22.81. Eastend, a centre southwest of Swift Current with a population of 784, had the second lowest price, at \$18.81. The price in Regina was \$20.62, 9.8 percent higher than Veregin. A possible reason for this phenomenon was that Veregin, Eastend and some of the other centres that had smaller stores with lower turnovers were selling stock held for a longer time but purchased at a lower price. This is an important point, since food prices had risen substantially in the three months<sup>3</sup> preceding the survey. This suggests that if the survey had been conducted in a period of stable prices the food basket prices for centres with small populations and lower-turnover stores would have been much greater than those observed.

The average price of the food basket for all stores in Saskatchewan was \$22.81, with each store's price deviating \$1.61 from the mean. The highest price was \$34.06, in Southend in northern Saskatchewan, 83.1 percent higher than that at Veregin, which had the lowest price (Table 2).

**TABLE 2. RANGE OF PRICES OF FOOD BASKETS FOR SASKATCHEWAN**

|                                | Including Far North Centres | Excluding Far North Centres | Far North Centres Only |
|--------------------------------|-----------------------------|-----------------------------|------------------------|
| Highest Price                  | \$34.06                     | \$25.25                     | \$34.06                |
| Lowest Price                   | 18.60                       | 18.60                       | 22.70                  |
| Mean                           | 22.81                       | 22.49                       | 26.42                  |
| Average deviation <sup>a</sup> | 1.61                        | 1.38                        | 3.02                   |

<sup>a</sup> Average deviation was calculated by taking the absolute value of the differences in the food basket price from the mean and dividing by the number of stores.

Source: Survey questionnaire

The price categories of the food baskets for the various centres surveyed are mapped in Figure 1. It does not show any systematic geographical price variation in Saskatchewan. That is, food basket prices do not necessarily increase as one moves farther away from a city.

<sup>3</sup> The Consumer Food Price Index for April 1974 was 180.8 and for June 1974 was 188.4, an increase of 7.6 points in three months (Statistics Canada, Prices and Price Index, September, 1974).

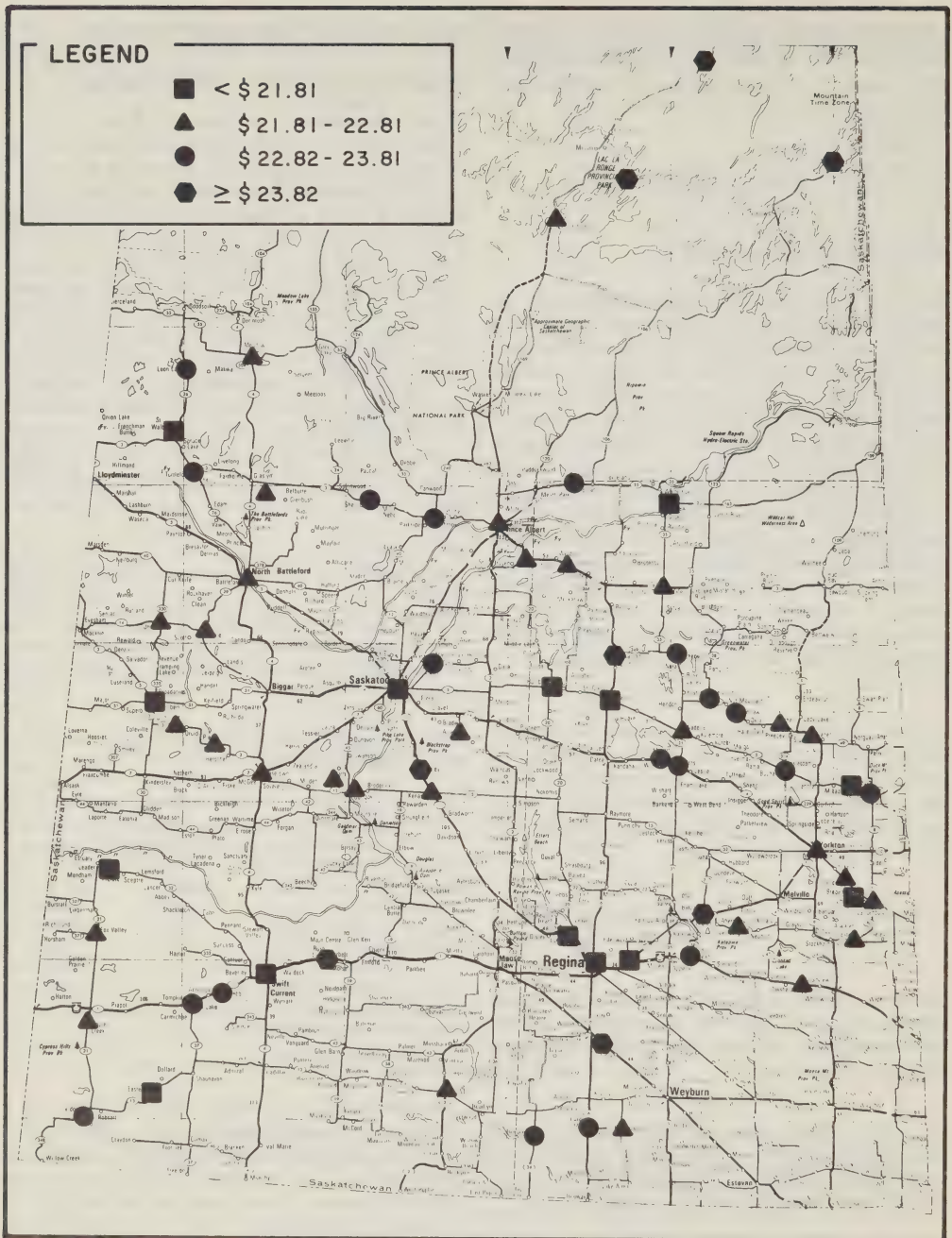


Figure 1. Location of Centres as Categorized by Food Basket Prices.

As illustrated in Table 2, for all surveyed centres, the average food basket price at each centre deviated \$1.61 or 7.1 percent, from the mean. In southern Saskatchewan each centre's deviation was \$1.38, or 6.2 percent, from the mean, and in the far north each centre's<sup>4</sup> deviation was \$3.02 or 11.4 percent. Since the food basket price for each centre was the average of all stores in that centre, the deviations indicated in Tables 2 and 3 are an underestimation of the deviation among stores in these centres.

**TABLE 3. RANGE AND PERCENTAGE DEVIATION OF SOUTHERN SASKATCHEWAN CENTRES FOOD BASKET PRICE BASED ON THE POPULATION CATEGORY**

| Population  | (1)<br>Highest Food<br>Basket Price | (2)<br>Lowest Food<br>Basket Price | Percentage Range<br>Between Each<br>Category (Col. 1/Col. 2) |
|-------------|-------------------------------------|------------------------------------|--|
| <500        | \$24.46                             | \$18.60                            | 31.5   |
| 501-1,000   | 25.01                               | 18.81                              | 33.0   |
| 1,001-2,500 | 25.25                               | 20.66                              | 22.2   |
| 2,501-5,000 | 23.01                               | 21.18                              | 8.6  |
| >5,000      | 22.65                               | 19.40                              | 16.8   |

Source: Survey questionnaire

### Centre Size Price Variation

The high variation in food basket prices for centres with a population of less than 1,000 (Table 3) can be partially explained by the distance between retailer and wholesaler, the level of inventories and rates of turnover. Also, the distribution policies of the wholesalers appear to be quite variable. Some small stores in rural areas pay transportation costs from the wholesaler while stores of a similar size in towns and cities pay no transportation costs from the same affiliated wholesaler.

The following is an actual case. Centre A is a large central city, B is a small city and C is a centre with a population of less than 1,000. Because a wholesaler is present in B as well as A, all merchants in B receive their goods at wholesale prices but with no extra transportation charge even though the merchandise comes from A; whereas, merchants in C, a smaller centre near B, obtain their groceries from the same wholesaler in A and must pay the transportation charge from A. Centre C merchants pay freight costs on 100 miles, whereas B merchants pay no freight costs on the 80 miles from A. Since goods cannot be shipped free from A to B, wholesalers add this cost to the wholesale price, which results

in the smaller stores such as those in C paying part of the transportation costs to the larger centres such as B.

Generally, the price of the food basket declines as the centre size increases; however, the average price of the food basket for the centres with 501-1,000 people was 6 cents less than that in the next larger centres, i.e., with a population of 1,001-2,500 (Table 4). When the population exceeded 2,500, the food basket price was lower, mainly because larger stores are found in the larger centres. The average price of the food basket in the smaller centres (less than 500 persons) was greater by \$1.34, or 6.1 percent, than that in the cities with a population greater than 5,000. Groceries costing \$40 in the small centre would cost only \$37.59 in the cities, a saving of \$2.41. If it costs 12 cents per mile to operate an automobile, travelling more than 20 miles for the purchase of groceries alone would be unprofitable. One would suspect rural people would only buy groceries in the urban centre if they were going there for multiple shopping purposes.

**TABLE 4. AVERAGE PRICE OF FOOD BASKET BY SIZE OF CENTRE**

| Categories of<br>Centre Population | Number of Centres                | Average Price of<br>Food Basket |
|------------------------------------|----------------------------------|---------------------------------|
| <500                               | 20                               | \$22.74                         |
| 500-1,000                          | 17                               | 22.59                           |
| 1,001-2,500                        | 18                               | 22.65                           |
| 2,501-5,000                        | 8                                | 22.15                           |
| >5,000                             | 6                                | 21.40                           |
| Far North                          | 5                                | 27.18                           |
| Total                              | 69 Ave.<br>(excluding Far North) | \$22.49                         |
| Total                              | 74 Ave.<br>(including Far North) | \$22.81                         |

Source: Survey questionnaire

### Far North Price Variation

In the far north the average price of the food basket in the urban centres was \$23.87 compared with \$29.38 in the rural centres. Thus, the rural consumer in the far north paid 23.1 percent more for food than people shopping in the urban area. The rural consumer here also paid 30 percent more than rural consumers in the rest of Saskatchewan. Urban consumers in the far north paid 6.8 percent more than their urban counterparts in the rest of the province. Most of the higher food prices in the far north were a result of two factors: (1) the stores surveyed were an average of 268 miles from their wholesaler compared with an average of only 65 miles for the rest of the stores in the sample, and (2) these stores required larger inventories in relation to their rate of turnover.

<sup>4</sup> Far north refers to centres north of La Ronge.

## Food Price Differentials by Commodity Groups in Saskatchewan

As well as comparing food basket prices, the study also examined price differences among groups of similar commodities. The food basket was divided into four groups: dairy products and eggs, meat, fruit and vegetables; and other groceries (coffee, bread, sugar, flour, etc.).

Price variations were greater for certain groups of food products than for others (Table 5). Fruits and vegetables had the widest price variation among centres in each region. This was due to the relatively large variation in the price of potatoes, which constituted a large part of fruit and vegetable products. The price for 10 pounds of potatoes ranged from \$1.39 to \$2.99. The smallest variation was in dairy products and eggs, due partly to the fact that milk and egg prices are controlled in the provinces, causing very little spatial price difference. The comparison of prices for meat products, especially fresh cuts, was difficult since there was no measurement of quality or grade of some of the cuts. For meat products of similar quality and the same grade, there was an apparently large variation in prices in stores of the same area and organization. The wide range of price variation in the other groceries group was due partly to the substantial price increases prior to the survey (footnote 3) and partly to the pricing policies of the various stores.

**TABLE 5. PERCENTAGE PRICE VARIATIONS WITHIN COMMODITY GROUPS FOR THE DIFFERENT AREAS OF SASKATCHEWAN<sup>a</sup>**

| Regions          | Dairy Products | Meats | Fruits & Vegetables | Other Groceries |
|------------------|----------------|-------|---------------------|-----------------|
| Saskatoon        | 7.7            | 16.0  | 31.9                | 15.7            |
| North Battleford | 6.4            | 36.2  | 46.9                | 6.9             |
| Yorkton          | 5.7            | 15.6  | 55.4                | 23.3            |
| Regina           | 5.7            | 14.6  | 78.4                | 21.1            |
| Prince Albert    | 5.4            | 12.7  | 20.3                | 9.3             |
| Swift Current    | 7.4            | 26.5  | 75.4                | 17.7            |
| Far North        | 35.4           | 16.2  | 57.4                | 52.1            |

<sup>a</sup>The figures show the percentage difference between the highest and lowest prices.

Source: Survey Questionnaire

## REGRESSION RESULTS

The variables expected to affect price differences can be grouped into the following categories: store size; services offered; location; population of centre; number of stores; type of store; store organization; and growth of centre. By analyzing these variables, it was found that:

- (1) for every 10 miles a centre's distance from the next higher hierarchical<sup>5</sup> centre increased, the price of the food basket increased 18 cents;
- (2) for every 1,000 square feet the store increased in size, the price decreased 8 cents;
- (3) for every \$100,000 increase in store sales, the price declined 5 cents;
- (4) for every \$10,000 in salaries paid by the store, the price declined 10 cents;
- (5) for every \$1,000 of net income, the price declined 3 cents.

This linear relationship suggests the food basket price is influenced by the size and the location of the store.

The above linear relationship yielded a low multiple-correlation co-efficient ( $R^2$ ) — 40 percent of the variation in the dependent variables (food basket prices) was explained by the independent variables. Several things can explain the low  $R^2$  results.

First, the data are cross-sectional. It is therefore possible to have the same size of firms in various positions along their short run average cost (SRAC) curve and different stores operating under completely different cost conditions. Since the study deals with only one point in time, unexplained variations due to varying cost structures of the individual stores may arise.

Second, important variables are probably missing. Food prices were increasing rapidly prior to data collection. Also, different stores have different rates of inventory turnover. In many cases rural retailers were selling food items at the original wholesale purchase price plus the normal mark-up, whereas in the urban centre retailers were making weekly changes in retail prices even though they had received the products from the wholesaler in previous weeks.

Several additional hypotheses were tested. It was hypothesized that the price of the food basket should increase as the distance between the store and both the nearest city and its wholesaler increases. Also, it was hypothesized that a rural retailer treats his service as a convenience to the rural consumer and thus sets his prices according to what the nearest higher hierarchical centre is charging. The study found, however, that

<sup>5</sup> Hierarchical is a term denoting the ranking of centres based on the services they offer. As a centre grows in size, more services are offered so that the centre increases to a higher level of the hierarchical ordering.

distance from the nearest city and wholesaler to the rural retailer was not significant while distance to the nearest higher hierarchical centre was. This suggests that stores in small centres set their prices first according to what the nearest higher hierarchical centre charges and second according to what the closest city charges. This further suggests that the competition for the rural store in a small community is the stores in the nearest larger centre rather than the stores in the closest city.

It was hypothesized that price is a function of the type of store ownership. An affiliated store can enjoy the cost advantages of bulk purchasing without operating a large store. One would suspect that the price of the food basket in the chain store would be lowest because of the high degree of vertical integration and economies of scale. It is impossible to hypothesize whether stores affiliated with a wholesaler but independently owned, and co-operatives, should have price differences since the differences in the degree of integration are not known. Independent store owners should have the highest price because of their complete lack of vertical integration. The analysis showed that the food basket price was significantly lower for chain stores compared with non-chain stores. However, the results were inconclusive in establishing differences among the non-chain stores.

Various other hypotheses were tested, including: (1) as sales per square foot increase, the price of the food basket should decline; (2) the larger the population of the centre, the lower the food basket price should be; and (3) the greater the degree of competition in centres, the lower the food basket price should be. However, no significant relationships were found.

## CONCLUSIONS

The major conclusions of this study are the following:

Although some price difference was found between rural and urban centres, it was suspected that under more stable price conditions, food prices would likely be higher in rural areas than the data indicate. Since the food price index had risen 7.6 points during the three months preceding the survey, stores with low turnover would be selling products purchased at lower wholesale prices.

Distance from a centre to the nearest higher hierarchical centre explained the largest amount of the spatial price

differences. This suggests that the competition for the rural centres is the stores in the nearest higher hierarchical centre rather than the stores of the closest city.

When variables indicative of store size increased, the price of the food basket declined.

## RECOMMENDATIONS FOR FURTHER STUDY

It would be desirable, in further studies, to do several surveys of prices, that is, one each week for an extended period. This would allow confidence in determining the extent of price variation in space and time by minimizing the effect of inventory turnover and the lag in rural prices adjusting to wholesale price changes.

More work should be done on the pricing and marketing behavior at the retail and wholesale levels for the various types of stores and store ownership. Transportation costs and policies of different wholesalers should be analyzed to determine their effect on rural food prices.

The results of this study should be an invitation to further investigation of prices in different centres of various sizes with different numbers of stores. It would seem very important to concentrate on recording prices of all stores in each centre selling the same goods. Although this study dealt only with food prices, another study should look at the other components of the cost of living in rural and urban centres. In such a study, one might gain further understanding of the level of retail prices across Saskatchewan and how much they vary by type of item and by location.

## REFERENCES

1. Maley, Doug L.V., "Spatial Variation in Food Prices for Selected Saskatchewan Centres", unpublished M.Sc. thesis, Department of Agricultural Economics, University of Saskatchewan, November 1975.
2. Statistics Canada, Canada Year Book, 1973.
3. Statistics Canada, Family Food Expenditure in Canada, Queen's Printer, Ottawa, 1969.
4. Statistics Canada, Price and Price Index, Queen's Printer, Ottawa, September, 1974.

# LEGISLATION

## FEEDS ACT (Formerly Bill S-10)

### Amendments, March 1976

The last major revision of this Act was in 1960. Recent changes in the livestock and feed manufacturing industries made these amendments necessary. One major amendment broadens the definition of feed to include all products and ingredients that can be used in livestock feeding, such as amino acids, anti-oxidants, non-protein nitrogen products (urea and ammonium phosphates), and pelleting and coloring agents.

Another amendment changes the definition of livestock to include fish, since these are now being farmed much as land animals are. Feeds for fish farms may now be regulated under the Act.

The change affecting farmers most directly concerns feed manufactured on the farm. The Act now gives authority for inspectors to check feeds made on the farm or feeder premises; but inspectors will be concerned only with the use of drugs and other ingredients that could adulterate food. The section regarding penalties for violations of the Act or of its regulations has also been brought up to date. A corporation found guilty of an offence under the Act can be fined, and the fine is not limited by the Act. The regulations are expected to be drawn up and in effect in about a year.

## AN ACT TO AMEND THE CANADIAN WHEAT BOARD ACT — No. 2 (Bill C-88)

This amendment, concerning the separate pooling of malting barley, has received third reading in the House of Commons, and is on its way to becoming law. The main provisions of the amendment were announced March 10 by Otto Lang, Minister Responsible for the Canadian Wheat Board. Under the agreement it will be possible to treat deliveries of malting barley in the

current crop year as a separate pool account. Previously the proceeds from barley selected for malting had to be pooled together with those of all sales of Number 1 feed barley irrespective of the end use.

The Bill also provides for direct election of producers to the CWB Advisory Committee by producers themselves, instead of, as at present, by the Governor in Council (See Summary in April issue of Canadian Farm Economics).

## UNITED GRAIN GROWERS ACT (Formerly Bill S-33)

### Amendments effective June 15, 1976

This Act, which originated in 1911, is a private Act of Parliament designed to incorporate the United Grain Growers as a company. It was last amended in the Statutes of Canada 1966-67 (Chapter 121).

The present amendment of Clause 1 increased the authorized capital of the company from \$12 million to \$25 million. It divided the capital stock into one million, two hundred thousand Class A shares at a par value of \$20 each, and two hundred thousand Class B (Membership) shares at a par value of \$5 each (in place of five hundred and fifty thousand Class A and two hundred thousand Class B at the same par values).

The amendment authorized a dividend rate not above 3 percent of the par value of Class A shares.

Clause 3 of the amendment makes it clear that the rights already attached to Class A shares (Bylaw 30 in the Schedule) apply to the additional shares that the company is now authorized to issue.

The company is given a French corporate name for the first time: "Union des producteurs de grain Limitée."

# PROGRAMS AND POLICIES

## Dairy Policy Changes

In June the minister of Agriculture, Mr. Whelan, announced some modifications of the government's dairy policy, which was made public in April. (For a summary of the main points see Canadian Farm Economics, June.)

In answer to urgent requests from Quebec dairy farmers, the Minister indicated three areas of possible government action which, he said, could help producers who were in financial difficulty owing to over-production or other circumstances beyond their control: (1) the Farm Credit Corporation could agree to defer loan payments for dairy farmers; (2) the government could consider some less restrictive quota arrangements than the present monthly ones; and (3) the government could examine, without commitment, production between the 95 million hundredweights required for the domestic market and the 100.5 million hundredweights of Total Market Share Quota. But, Mr. Whelan stressed, the government could do nothing until they were assured that farmers had dairy production under control regarding market requirements. For dairy farmers having trouble repaying Farm Credit Corporation loans, Mr. Whelan said, the FCC would look at every case and would not take action against borrowers who faced problems beyond their control. Quebec dairymen, who produce over half the country's industrial milk, had been protesting cuts in production and subsidies since the federal dairy policy was announced.

## Domestic Feed Grain Policy

On May 31 the Minister of Agriculture and the Minister Responsible for the Canadian Wheat Board (CWB) outlined new measures to improve the domestic market for feed grains. They emphasized that the basic policy was still to encourage growth of livestock and feed grain production across the country, to end any discrimination in freight rates between meat and grain, to have a fair pricing system for all Canadian feed grains and to ensure security of supplies.

The new policy developments were: (1) to make domestic feed grains available at corn-competitive prices; (2) to relocate reserve stocks; (3) to modify assistance to feed freight; and (4) to fund programs to assist the feed-livestock industries.

Mr. Whelan described these measures as guaranteeing a dependable flow of feed grain to the domestic market at competitive prices, relieving temporary shortages and disparities in regional markets, and ensuring the reaching of objectives announced in the domestic feed grain policy statement of May 22, 1974.

Mr. Lang announced that by August 1, 1976, the CWB would be offering western feed grain to the domestic market at prices competitive with U.S. corn. Prices at Thunder Bay and western country elevators would be the Montreal corn-competitive price less costs of transportation and handling. Modifications of freight assistance rates would be effective August 1.

## Vancouver Terminal Incentive Program

The Canadian Wheat Board announced on June 2 that it had received commitments for construction of 10.4 million bushels of additional terminal capacity in the port of Vancouver. Commitments were made under the incentive program announced by the CWB in April, the objective being to increase the capacity and dependability of West Coast facilities.

## Rapeseed Freight Rates

On May 4 Otto Lang, the Minister of Transport, described changes in freight rates to be charged by railways on shipments of rapeseed products. The changes were intended to minimize the discrepancy between shipping rates on rapeseed oil and on the seed itself. A recent Order in Council instructed the Canadian Transport Commission to publish tariffs affecting shipments of rapeseed products at levels not above the minimum compensation for costs incurred in moving the products. This so-called "compensatory" level is lower than full cost recovery. The commission was expected to comply with the order by June 30.

## Support Prices for Corn and Soybeans

Support prices for corn and soybeans for the 1975-76 crop year were announced May 28. For corn the price is \$2.11 a bushel; for soybeans it is \$4.35 a bushel; both were in effect until August 31, 1976. Calculations to determine if producers of these two crops will receive payments under the stabilization plan will not be made until after August 31, 1976.

## New Crop Development Fund

It was announced June 10 that a total of \$248,239 will be provided by Agriculture Canada's New Crop Development Fund over the next three years. Agriculture Minister Whelan has signed agreements with the University of Saskatchewan for projects to develop flax as a major prairie crop and to produce winter rye in the black and gray soil zones of the province; with the Foothills Forage Co-op Association of Calgary to

evaluate the use of certain oat varieties as forage; and with the Continental Grain Company of Winnipeg to establish mustard crops in Ontario, Quebec and New Brunswick.

The New Crop Development Fund was established in 1974 to help farmers apply the results of basic research. Money is available to groups that have workable plans to develop new crops and varieties or to expand production of established crops.

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## PUBLICATIONS

### ECONOMICS BRANCH, AGRICULTURE CANADA

*Available from the Publications Manager, Room 303, Sir John Carling Building, Ottawa, K1A 0C5.*

**Canada's Trade in Selected Farm Inputs, 1945-75.** P. Karpouris and D. Shute. Pub. No. 76/11, 45 pp.

**Canada's Trade in Agricultural Products, 1973, 1974, 1975.** D.L. Bolton. 52 pp. Pub. No. 76/8

**Co-operation in Canada.** J.M. Sullivan. 26 pp. Pub. No. 76/4.

**Handbook of Food Expenditures, Prices and Consumption.** Z.A. Hassan and D. Karamchandani. 87 tables. June 1976. Pub. No. 76/5.

**Marketing Board Statistics, Canada, 1974-75.** J.M. Sullivan. July 1976, 14 pp. Pub. No. 76/7.

**Farm and Off-farm Incomes, 1973.** W. Darcovich and M. Mouelhi. June 1976. Pub. No. 76/6.

### AGRICULTURE CANADA

*Available from the Information Division, Agriculture Canada, Carling Building, Ottawa, K1A 0C7.*

**Agriculture Canada Annual Report, 1974-75** 48 pp. Tables. Cat. No. A1-1975.

**Lands Directorate (Alberta Land Use Planning Branch).** 104 pp. \$1.25 a copy (\$1.50 abroad). Cat. No. EN. 73-1/5.

**Management of Prairie Range Land.** Cat. No. 1589.

**New Crop Development Fund (1976).** Bilingual. Cat. No. 1580.

**Swine Production and Management (1976).** Cat. No. 1442.

### OTHER PUBLICATIONS

*Write to Printing and Publishing, Publications Centre, Mail Order Services, Supply and Services Canada, Ottawa, K1A 0S9.*

**Dairy Statistics (1975).** 23 pp. Tables, graphs. Bilingual. 70¢ a copy. Cat. No. CS 23-201/1975.

**Estimate of Production and Disappearance of Meats, 1975.** May 1976. 7 pp. Tables. Bilingual. Looseleaf. 35¢ a copy. Cat. No. CS 32-220/1975.

**Fruit and Vegetable Production.** Seasonal. Bilingual. 40¢ a copy, \$3 a year. Cat. No. CS 22-003.

**Oilseeds Review.** Quarterly. Bilingual. May 1976. 57 pp. \$1.05 a copy, \$4.20 a year. Cat. No. CS 22-006.

**Stocks of Frozen Meat Products.** April 1976. 12 pp. Bilingual. 30¢ a copy, \$3 a year. Cat. No. CS 32-012.

## IN REPLY

The article on Trends in Food Consumption, Prices and Expenditures by Danielle Karamchandani in the February issue of Canadian Farm Economics brought a response from Mr. C.A. Gracey, Manager of the Canadian Cattlemen's Association. Mr. Gracey wrote, in part: "I would like to commend you for the excellent and impressive study . . . This is an excellent source document for us and I think the information contained will prove useful in many ways. I would just like to raise a couple of points for your consideration. First of all I would like to draw your attention to Figure 1 entitled Consumption Per Capita of Food, which illustrates a generally rising trend for plant products and a declining trend for animal products. I assume that there is an error in the table and that the dotted line relates to all foods, whereas the lower line relates to animal products. My main concern however is that this table depicts a trend which may in fact be an over-simplification. If you look at Table 4, you will find that red meat consumption, fats and oils, and poultry experienced increase in consumption against the apparent trend in your table. A decline in the consumption of animal products is almost entirely attributed to a decline in dairy products and in eggs. Therefore, if you are developing the thesis that there is a decline in consumption of animal products offset by an increase in the consumption of plant products, I think the thesis is somewhat in error, or at least not sufficiently specific.

"It is interesting to note as well that both red meat consumption and poultry consumption increased at a greater rate than the average for all foods, even though the price of these products also increased at a greater rate than the average for all foods. By contrast, consumption of eggs and dairy products declined, even though the prices of these products did not increase at the same rate as the prices for all foods increased. . . . It casts some doubt at least on the simple thesis that plant products are replacing animal products in the human diet. My view is that individual commodities should be considered individually, and that a generalized case cannot be stated for plant vs animal products."

The author's reply to Mr. Gracey reads, in part: "I agree with you that it is not always proper to aggregate commodities in major categories in order to compare their trends through time. In fact, it was because of this realization that individual treatment is more precise that I qualified several figures on consumption of various

food items with a brief discussion on each one of them, to clarify what really was the trend in consumption of animal and plant products between 1961 and 1974. Once again, thank you for your remarks. Please be sure they will be considered for future studies."

In response to the April issue, Mr. G.S. Colquhoun of Calgary writes that "articles dealing with marketing of agricultural products are the most useful." He referred especially to Demand Projections for Agricultural Commodities, 1980 and 1985.

Guy L. Kerr, district agriculturist, Rimbey, Alberta, responded to the April article on Canada's Pasture Potential. "I'm concerned that a large number of acres of land are being used for crop production when they are better suited for forages," he writes. "My area here is largely suited for forage production. Feed grains are grown quite successfully, but I feel forages could be a better 'land use.' I'm glad to see that more knowledgeable people than myself think somewhat the same way." His comments have been sent to the authors in Lethbridge, Alberta.

Phil Thomas, agrologist, Vermilion, Alberta, found that the April article on Palm Oil in World Markets "imparts a better knowledge of the world oilseed market and future trends." On the article on Farm Business Management Training in the same issue, Mr. Thomas writes, "I hope that the new Farm Business Management training program proceeds swiftly as it is a good one".

Robert N. Plank, assistant branch manager, Farm Credit Corporation, Kelowna, B.C., asked some questions about W.G. Freeman's article in the February issue on the Agriculture-Population Linkage Program. These have been passed on to the author, who is not available for reply at present. We hope to print his comments in a later issue.

J. Wilson Loree, head of the Farm Business Management Bureau of Alberta Agriculture, Edmonton, referred back to the December article on National and Regional Productivity of Canadian Agriculture when he wrote: "Had difficulty visualizing the deflating system used for real estate inputs index. Perhaps the reason for lower productivity in the West is that western agriculture is in Stage II of the production function (decreasing output per added unit of input) while eastern Canadian agri-

culture is in Stage I (increasing output per added unit of input)." The author is grateful for this view, and will answer Mr. Loree before long.

Tom Sawyer of Freelon, Ontario, writes that he would like an index of articles, by crops, animals, etc., covering

the last five years of this publication. Agreed, says the editor; it will be done.

Thanks are extended for comments from E.T. Gibbon, University of Nairobi, Kenya; and Barbara Geno, Lise-Marie Coté and J.E. McLachlen of Ottawa.

**IN REPLY TO AUTHORS AND EDITORS REGARDING AUGUST 1976**  
**CANADIAN FARM ECONOMICS**

I have read one or more of the following articles:

- (1) Livestock Auction Markets in the Maritime Provinces
- (2) Canadian Co-operatives – Their Growth and Finance
- (3) Trends in Production of Forage Crops in Canada
- (4) Retail Grocery Price Variation in Saskatchewan

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- 3. Why?
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| inch                   | x 25                                 | millimetre (mm)                      |
| foot                   | x 30                                 | centimetre (cm)                      |
| yard                   | x 0.9                                | metre (m)                            |
| mile                   | x 1.6                                | kilometre (km)                       |
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| square inch            | x 6.5                                | square centimetre (cm <sup>2</sup> ) |
| square foot            | x 0.09                               | square metre (m <sup>2</sup> )       |
| acre                   | x 0.40                               | hectare (ha)                         |
| <b>VOLUME</b>          |                                      |                                      |
| cubic inch             | x 16                                 | cubic centimetre (cm <sup>3</sup> )  |
| cubic foot             | x 28                                 | cubic decimetre (dm <sup>3</sup> )   |
| cubic yard             | x 0.8                                | cubic metre (m <sup>3</sup> )        |
| fluid ounce            | x 28                                 | millilitre (ml)                      |
| pint                   | x 0.57                               | litre (ℓ)                            |
| quart                  | x 1.1                                | litre (ℓ)                            |
| gallon                 | x 4.5                                | litre (ℓ)                            |
| <b>WEIGHT</b>          |                                      |                                      |
| ounce                  | x 28                                 | gram (g)                             |
| pound                  | x 0.45                               | kilogram (kg)                        |
| short ton (2000 lb)    | x 0.9                                | tonne (t)                            |
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| pounds per square inch | x 6.9                                | kilopascal (kPa)                     |
| <b>POWER</b>           |                                      |                                      |
| horsepower             | x 746<br>x 0.75                      | watt (W)<br>kilowatt (kW)            |
| <b>SPEED</b>           |                                      |                                      |
| feet per second        | x 0.30                               | metres per second (m/s)              |
| miles per hour         | x 1.6                                | kilometres per hour (km/h)           |
| <b>AGRICULTURE</b>     |                                      |                                      |
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| quarts per acre        | x 2.8                                | litres per hectare (ℓ/ha)            |
| pints per acre         | x 1.4                                | litres per hectare (ℓ/ha)            |
| fluid ounces per acre  | x 70                                 | millilitres per hectare (ml/ha)      |
| tons per acre          | x 2.24                               | tonnes per hectare (t/ha)            |
| pounds per acre        | x 1.12                               | kilograms per hectare (kg/ha)        |
| ounces per acre        | x 70                                 | grams per hectare (g/ha)             |
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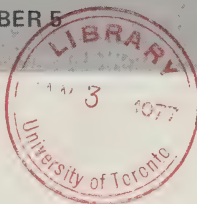
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OCTOBER 1976



# CANADIAN FARM ECONOMICS

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HON. EUGENE WHELAN, MINISTER — L. DENIS HUDON, DEPUTY MINISTER

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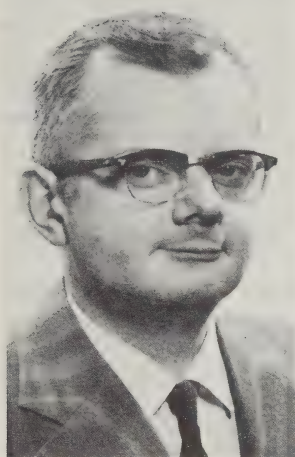
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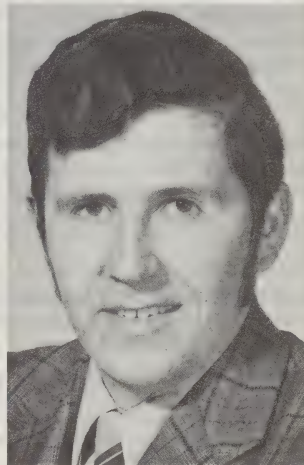
# ENERGY USE IN CROP PRODUCTION IN PRINCE EDWARD ISLAND\*



*Concern about energy conservation has increased the importance of technological research into the possibilities of reducing energy use in crop production. This article shows the percentage distribution of energy for eight major crops in Prince Edward Island and how they stand in terms of the ratio of output energy to input energy.*

*The major difference between energy efficiency and economic efficiency is also illustrated. The adoption of any new technology will depend on its relevance to the objectives of farmers.*

James Lovering and J.A. McIsaac\*\*



## INTRODUCTION

Recent sharp increases in the price of oil and natural gas, their products and other energy sources, plus the likelihood of further increases, have given rise to concern about energy conservation. High exploration costs and predictions of an absolute physical depletion of gas and oil reserves unless new reserves are proven have intensified this concern. Governments are actively promoting conservation and various public and private researchers are studying the potential and economic feasibility of other energy sources.

The resolution of the energy problem will likely demand high capital input and considerable new knowledge and technology. Any attempts to significantly increase

energy efficiency will first require estimates of energy use and the relationships between energy input and product output for the various sectors of the economy. This article provides information of this nature for the agricultural sector. Specifically, the purpose of the article is to show the distribution of energy use in the production of a variety of crops in Prince Edward Island, to estimate current energy output/input ratios for these crops, and to illustrate the difference between energy efficiency and economic efficiency.

## METHOD

Estimates of energy used in crop production were based on information on crop management practices provided by specialists at the Charlottetown Research Station and the Prince Edward Island Department of Agriculture and Forestry. Data on crop acreages were taken from provincial agriculture statistics bulletins. Estimates of energy used in the manufacture of machines, fertilizers and pesticides were taken from Geno (1) and Southwell and Rothwell (5) and are shown in the appendix. Energy for machine manufacture was taken to be the same per

\*The tabular data in this article dealing with energy requirements for crop production are taken from "The Energy Situation in the Prince Edward Island Agricultural Industry", by L.B. MacLeod, J.H. Lovering, and J.A. McIsaac, which was presented to the Prince Edward Island House of Assembly during "Energy Days", March 30, 31 and April 12, 13, 1976.

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pound for all machines (5)<sup>1</sup>. Energy for pesticide manufacture per pound of active ingredient was assumed to be constant for all products<sup>2</sup>.

Farm size is a variable of some importance in calculating the energy used for 'machine manufacture and delivery' on a per-acre basis. This calculation requires information on the acreage covered or hours worked by the machine during its life, and its work rate. Tractors were assumed to operate 600 hours per year and to have a lifespan of 10,000 hours; other machines were assumed to be used 100 hours per year and to have a 10-year life.

Machine- and man-work rates (acres per hour) were taken from cost-of-production studies (6) (7) and unpublished time-motion data obtained from farming operations in Prince Edward Island.

The estimates of the amount of energy used by the various crops do not include energy used in transportation within farms, crop drying (except for tobacco), the use of chemical preservatives (such as acetic or propionic acid), or the energy used in building and maintaining crop storages.

## CROP ENERGY USE

Energy inputs per acre for cereals and potatoes are shown in Tables 1 and 2. Potato production requires about three times the energy used by cereals. The shares of energy used for machines, lime and fertilizer, and seed, however, are similar.

Energy input and output (digestible energy)<sup>3</sup> for eight crops are shown in Table 3. The table also shows how each crop stands in terms of the ratio of output energy to input energy. The feed crops — hay, pasture, cereals, and corn silage — show a higher ratio of output to input energy than do the more intensively-grown potato and vegetable crops. Since the energy input shown in the table excludes such sources as the sun, the output/input ratio is as much a reflection of crop management practices as the nature of the plant species grown.

<sup>1</sup> Southwell gives examples of energy for machine manufacture ranging from 31.30 MJ/lb for 70-horsepower tractors to 28.87 MJ/lb for 12-foot spring-tooth harrows.

<sup>2</sup> Most pesticides are either solution or wettable powder formulations. Some emulsifiable concentrates are used. The amounts of energy used for solution and wettable powder formulations are equal, while emulsifiable concentrates use 80 to 100 percent more than either of the others.

<sup>3</sup> For a definition of digestible energy see the appendix.

**TABLE 1. PER ACRE ENERGY USE FOR CEREALS, P.E.I.**

|  | MJ*/ac  | %     |
|--|---------|-------|
| Labor, 2.6 hr                                      | 5.9     | .1    |
| Nitrogen, 30 lb                                    | 1,233.2 | 18.1  |
| Phosphorus (P <sub>2</sub> O <sub>5</sub> ), 40 lb | 367.8   | 5.4   |
| Potassium (K <sub>2</sub> O), 40 lb                | 267.2   | 3.9   |
| Lime, 660 lb                                       | 1,896.8 | 27.8  |
| Pesticides, 1.06 lb A.I.                           | 135.3   | 2.0   |
| Seed, 100 lb                                       | 951.1   | 14.0  |
| Manufacture and delivery of machines               | 274.5   | 4.0   |
| Diesel fuel and lubrication                        | 1,680.7 | 24.7  |
| Total  | 6,812.5 | 100.0 |

\*megajoules.

**TABLE 2. PER ACRE ENERGY USE FOR POTATOES<sup>a</sup>, P.E.I.**

|   | MJ/ac    | %     |
|---|----------|-------|
| Labor, 29.5 hr                                      | 67.2     | .3    |
| Nitrogen, 140 lb                                    | 5,755.1  | 26.9  |
| Phosphorus (P <sub>2</sub> O <sub>5</sub> ), 200 lb | 1,838.8  | 8.6   |
| Potassium (K <sub>2</sub> O), 170 lb                | 1,135.6  | 5.3   |
| Lime, 500 lb  | 1,437.0  | 6.7   |
| Pesticides, 12.5 lb A.I.                            | 1,595.9  | 7.4   |
| Seed, 1800 lb                                       | 3,425.0  | 16.0  |
| Manufacture and delivery of machines                | 868.1    | 4.1   |
| Diesel fuel, lubrication and electricity            | 5,293.6  | 24.7  |
| Total   | 21,416.3 | 100.0 |

<sup>a</sup>Graded, f.o.b. farm.

Overall energy requirements for each major crop grown in Prince Edward Island are given in Table 4. Cereals and potatoes use 73 percent of the energy used by all crops combined. The growing of forages for producing meat and milk uses only a small amount of energy (fossil fuel).

Table 5 shows the percentage distribution of energy use for eight major crops. The large values for "other" shown for cereals, potatoes and processing peas reflect high seeding rates, and for tobacco the use of large amounts of fuel for curing. Energy used in pesticide manufacture is a small part of total energy for each crop. Machine fuel and lubrication, fertilizer and lime together make up more than 60 percent of total energy use in all crops except tobacco, where most of the energy is in the form of fuel for curing.

Several measures of energy can be used in calculating output/input ratios for agricultural crops. Table 6 shows how ratios change with each energy measure chosen. The

**TABLE 3. PER ACRE ENERGY USE IN CROP PRODUCTION, P.E.I.**

| Crop                    | Total machine <sup>a</sup> | Machine fuel and lubrication | Fertilizer and lime | Pesticides       | Other <sup>b</sup> | Total energy input | Total energy output <sup>c</sup> | O/I   |
|-------------------------|----------------------------|------------------------------|---------------------|------------------|--------------------|--------------------|----------------------------------|-------|
| MJ/ac                   |                            |                              |                     |                  |                    |                    |                                  |       |
| Cereals                 | 1,955                      | 1,681                        | 3,765               | 135              | 957                | 6,812              | 12,358                           | 1.81  |
| Hay                     | 1,153                      | 1,004                        | 1,300               | —                | 11                 | 2,464              | 18,064                           | 7.33  |
| Pasture                 | 113                        | 107                          | 1,300               | —                | —                  | 1,413              | 18,396                           | 13.02 |
| Potatoes                | 6,162                      | 5,294                        | 10,167              | 1,596            | 3,492              | 21,417             | 34,167                           | 1.60  |
| Corn (silage)           | 3,623                      | 3,162                        | 6,635               | 383              | 185                | 10,826             | 40,439                           | 3.74  |
| Tobacco                 | 7,936                      | 7,400                        | 7,643               | 370 <sup>d</sup> | 23,334             | 39,283             | —                                | —     |
| Vegetables <sup>e</sup> | 3,314                      | 3,046                        | 12,415              | 766              | 199                | 16,694             | 9,331                            | .56   |
| Processing Peas         | 4,153                      | 3,674                        | 3,267               | 128              | 2,746              | 10,294             | 2,976                            | .29   |

<sup>a</sup>Includes 'Machine fuel and lubrication' column.

<sup>b</sup>Includes labor, seed and in the case of tobacco, curing.

<sup>c</sup>Digestible energy.

<sup>d</sup>Chemical sucker control.

<sup>e</sup>Includes broccoli, Brussels sprouts, beets, cabbage, beans, cauliflower, fresh corn, cucumbers, lettuce, parsnips, tomatoes.

**TABLE 4. CROP ENERGY USE, P.E.I.**

| Crop                  | Acres <sup>a</sup> | Energy use per acre | Total energy used | Total energy output <sup>b</sup> |
|-----------------------|--------------------|---------------------|-------------------|----------------------------------|
|                       |                    | MJ                  | TJ*               |                                  |
| Cereals <sup>c</sup>  | 174,000            | 6,812               | 1,185.3           | 2,150.3                          |
| Hay                   | 127,000            | 2,464               | 312.9             | 2,294.1                          |
| Pasture               | 114,000            | 1,413               | 161.1             | 2,097.1                          |
| Potatoes <sup>d</sup> | 47,000             | 24,417              | 1,147.6           | 1,605.8                          |
| Corn (silage)         | 12,000             | 10,826              | 129.9             | 485.3                            |
| Tobacco               | 3,540              | 39,283              | 139.1             | —                                |
| Vegetables            | 1,000              | 16,694              | 16.7              | 9.3                              |
| Processing peas       | 9,000              | 10,294              | 92.6              | 26.8                             |

<sup>a</sup>Acres are approximate for 1974 and 1975.

<sup>b</sup>Digestible energy.

<sup>c</sup>Includes 4,000 acres of feed peas.

<sup>d</sup>Includes 500 acres of rutabagas and 500 acres of carrots.

\*terajoules (10<sup>12</sup> joules).

biological measures of energy such as digestible, metabolizable and net<sup>4</sup> for a given crop vary with the animal species, the nature of the entire ration, level of feeding, and several other factors (8). When the consuming species and the level of input energy are held constant, variation in unit energy content of a crop occurs from year to year as a result of management and environmental factors.

End uses of crops need to be considered in interpreting energy output/input ratios; barley provides much more

**TABLE 5. PERCENTAGE DISTRIBUTION OF ENERGY USE IN P.E.I. CROPS**

| Crop                   | Total machine | Machine fuel and lubrication | Fertilizer and lime | Pesticides | Other |
|------------------------|---------------|------------------------------|---------------------|------------|-------|
| % of total energy used |               |                              |                     |            |       |
| Cereals                | 28.7          | 24.7                         | 55.2                | 2.0        | 14.1  |
| Hay                    | 46.8          | 40.8                         | 52.7                | —          | .5    |
| Pasture                | 8.0           | 7.6                          | 92.0                | —          | —     |
| Potatoes               | 28.8          | 24.7                         | 47.5                | 7.5        | 16.3  |
| Corn (silage)          | 33.5          | 29.2                         | 61.2                | 3.5        | 1.7   |
| Tobacco                | 20.2          | 18.8                         | 19.5                | .9         | 59.4  |
| Vegetables             | 19.8          | 18.2                         | 74.3                | 4.6        | 1.2   |
| Processing peas        | 40.4          | 35.7                         | 31.8                | 1.2        | 26.7  |

**TABLE 6. OUTPUT/INPUT RATIOS FOR VARIOUS ENERGY MEASUREMENT METHODS FOR BARLEY**

|                      | Yield | Output energy |        | Input energy | O/I  |
|----------------------|-------|---------------|--------|--------------|------|
|                      | lb    | kJ/lb         | MJ/ac  | MJ/ac        |      |
| Gross energy         | 2,000 | 7,862         | 15,724 | 6,812.5      | 2.31 |
| Digestible energy    | 2,000 | 6,179         | 12,358 | 6,812.5      | 1.81 |
| Metabolizable energy | 2,000 | 5,067         | 10,134 | 6,812.5      | 1.49 |

energy for humans when consumed directly than when it is converted to meat or other food products by an animal. In this light, the high energy output/input ratios shown for forages do not seem as attractive because when they are fed to animals energy is lost in their conversion to food products.

<sup>4</sup>For definitions of metabolizable and net energy, see the appendix.

## COMPARISON OF ENERGY AND ECONOMIC EFFICIENCIES

This section compares energy efficiency with economic efficiency by analyzing the effects of increasing the level of fertilizer application on three crops — potatoes, alfalfa-timothy and winter wheat. Energy efficiency is defined, for the purposes of this article, as the ratio of energy output to energy input (Table 3). Economic efficiency is the difference between the dollar value of the crop produced and the dollar value of fertilizer used.

It is impossible, for reasons of time and space, to discuss efficiencies in terms of all crop inputs. Fertilizer was chosen to illustrate the differences between energy efficiency and economic efficiency for two reasons: (1) it is a high-cost and high-energy input and (2) the economic implications of its use are well documented and can be clearly demonstrated.

As fertilization rates for potatoes, alfalfa-timothy and winter wheat are increased, energy efficiency decreases and monetary returns increase (Tables 7, 8 and 9). The data clearly indicate the decrease in yield or output that would result from lower fertilization rates.

Energy efficiency and economic efficiency differ widely as objectives in crop production. There is little doubt that economic efficiency is the major objective of farmers. If so, their attitude toward energy use and efficiency will be dictated largely by economics. They will continue to adjust input application rates according to input and output prices and the relationship between them. Thus, price increases for high-energy inputs (relative to output prices) will have an important impact

**TABLE 7. CHANGES IN MONETARY AND ENERGY RELATIONSHIPS IN RESPONSE TO FERTILIZER APPLIED TO POTATOES**

| Fertilizer <sup>a</sup><br>application | Potato<br>yield | Fertilizer<br>energy | Potato<br>energy <sup>b</sup> | Energy<br>output/<br>input <sup>c</sup> | Difference<br>between<br>fertilizer<br>costs and<br>potato value <sup>d</sup> |
|--|-----------------|----------------------|-------------------------------|---|---|
| lb/ac                                  | cwt/ac          | MJ/ac                | MJ/ac                         |   | \$/ac   |
| 0                                      | 181             | —                    | 29,499                        | —                                       | 905   |
| 400                                    | 244             | 3,419                | 39,699                        | 11.61                                   | 1,189   |
| 800                                    | 278             | 6,838                | 45,231                        | 6.61                                    | 1,329   |
| 1,200                                  | 289             | 10,257               | 47,020                        | 4.58                                    | 1,353   |

<sup>a</sup>15-15-15.

<sup>b</sup>162.7 MJ digestible energy (cattle) per cwt (2).

<sup>c</sup>Considering fertilizer only.

<sup>d</sup>Fertilizer values at \$153/ton and potatoes valued at \$5/cwt, field run.

**TABLE 8. CHANGES IN MONETARY AND ENERGY RELATIONSHIPS IN RESPONSE TO FERTILIZER APPLIED TO AN ALFALFA-TIMOTHY CROP**

| Fertilizer <sup>a</sup><br>application | Forage<br>yield | Fertilizer<br>energy | Forage<br>energy <sup>b</sup> | Energy<br>output/<br>input <sup>c</sup> | Difference<br>between<br>fertilizer<br>costs and<br>forage value <sup>d</sup> |
|--|-----------------|----------------------|-------------------------------|---|---|
| lb/ac                                  | lb/ac           | MJ/ac                | MJ/ac                         |   | \$/ac   |
| 0                                      | 4,295           | 0                    | 19,059                        | —                                       | 107.38  |
| 200                                    | 5,396           | 995                  | 23,944                        | 24.07                                   | 122.50  |
| 400                                    | 6,808           | 1,990                | 30,206                        | 15.18                                   | 145.40  |
| 600                                    | 7,577           | 2,984                | 33,622                        | 11.27                                   | 152.23  |
| 800                                    | 8,278           | 3,979                | 36,732                        | 9.23                                    | 157.35  |
| 1,000                                  | 8,695           | 4,974                | 38,582                        | 7.76                                    | 155.38  |

<sup>a</sup>5-10-30.

<sup>b</sup>4,437 MJ digestible energy (cattle) per lb — estimated.

<sup>c</sup>Considering fertilizer only.

<sup>d</sup>Fertilizer valued at \$124/ton and forage at \$50/ton.

**TABLE 9. CHANGES IN MONETARY AND ENERGY RELATIONSHIPS IN RESPONSE TO FERTILIZER APPLIED TO WINTER WHEAT**

| Fertilizer <sup>a</sup><br>application | Wheat<br>yield | Fertilizer<br>energy | Wheat<br>energy <sup>b</sup> | Energy<br>output/<br>input <sup>c</sup> | Differences<br>between<br>fertilizer<br>costs and<br>wheat value <sup>d</sup> |
|--|----------------|----------------------|------------------------------|---|---|
| lb/ac                                  | lb/ac          | MJ/ac                | MJ/ac                        |   | \$/ac   |
| 0 N                                    | 2,280          | 2,647                | 14,965                       | 5.65                                    | 108.40  |
| 30 N                                   | 3,132          | 3,880                | 20,557                       | 5.30                                    | 151.06  |
| 60 N                                   | 3,624          | 5,114                | 23,789                       | 4.65                                    | 172.12  |
| 90 N                                   | 3,660          | 6,347                | 24,023                       | 3.78                                    | 165.82  |

<sup>a</sup>In addition, 400 lb/ac of 10-20-10 was applied with each N treatment.

<sup>b</sup>6.57 MJ digestible energy (cattle) per lb.

<sup>c</sup>Considering fertilizer only.

<sup>d</sup>10-20-10 valued at \$142/ton, N at \$0.28/lb and wheat at \$0.06/lb.

on their use. Decreases in output due to cutbacks in inputs may be expected to result in higher food prices.

Large reductions in energy use in crop production will likely come from new technology in machine use and fertilizer requirements<sup>5</sup>. (Most of the energy used by crops, except tobacco, is in the form of machine fuel and lubrication and fertilizer and lime, as shown in Table 5). More widely applicable minimum or no-tillage

<sup>5</sup>It is recognized that some energy can be saved by cutting waste.

production systems, more reliable and widely adapted forage legumes and nitrogen-fixing cereals are possibilities for reducing energy use. Technological research in this field is of great importance. However, the adoption of any new technology will depend on its relevance to the objectives of farmers.

SUMMARY AND CONCLUSIONS

The data indicate the major components of energy use in the production of a variety of crops and, hence, the components that can be manipulated to significantly reduce energy requirements in crop production.

There is a major difference between energy efficiency and economic efficiency. Since farmers' objectives are primarily of an economic nature it is important that energy problems in agriculture not be considered in energy terms alone.

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REFERENCES

1. Geno, Larry M. Energy, Agriculture, and the Environment, Policy Branch, Environment Canada, mimeo, Ottawa, 1975.

2. National Research Council. United States-Canadian Tables of Feed Composition, second revision, National Academy of Sciences, 1969.

3. Munro, D.C., White, R.P., and Sanderson, J.B. 1972-1975 Research Summaries, Charlottetown Research Station, Agriculture Canada.

4. MacLeod, L.B. and MacLeod, J.A. 1971 Research Summary, Charlottetown Research Station, Agriculture Canada.

5. Southwell, P.H. and Rothwell, T.M. Report on Analysis of Output/Input Energy Ratios of Crop Production in Ontario, School of Engineering, University of Guelph, March 15, 1976.

6. Lovering, James, MacMinn, D., and Ryle, G. Cost of Production Studies, Atlantic Agricultural Economics Committee, 1970, 1971.

7. Lovering, James. A Guide to Estimating Farm Machinery Costs, Atlantic Agricultural Economics Committee, No. 5, January 1972.

8. Crampton, E.W. Applied Animal Nutrition, Freeman, San Francisco, 1956, p. 70.

APPENDIX

Energy equivalent<sup>1</sup> of crop inputs have been taken to be:

|  |   |     |
|--|---|-----|
| Labor  | 2,277 kJ*/hr                              | (1) |
| Nitrogen fertilizer from ammonium nitrate        | 41,108 kJ/lb N                            | (5) |
| Phosphorus fertilizer from triple superphosphate | 9,194 kJ/lb P <sub>2</sub> O <sub>5</sub> | (5) |
| Potassium fertilizer from muriate of potash      | 6,680 kJ/lb K <sub>2</sub> O              | (5) |
| Pesticides                                       | 127,673 kJ/lb A.I.**                      | (5) |
| Diesel oil                                       | 205,303 kJ/gal                            | (5) |
| Manufacture and delivery of machines             | 30,000 kJ/lb                              | (5) |
| Lime   | 2,874 kJ/lb                               | (5) |

Energy equivalent of seed measured in terms of gross energy, has been assumed to be 9,523 kJ/lb on a dry matter basis.

Yields and energy concentrations are taken to be:

|                   |  |
|-------------------|--|
| Cereals           | 2,000 lb/ac and 6,179 kJ digestible energy/lb  |
| Hay               | 4,000 lb/ac and 4,516 kJ digestible energy/lb  |
| Pasture           | 4,000 lb/ac and 4,599 kJ digestible energy/lb  |
| Potatoes          | 21,000 lb/ac and 1,627 kJ digestible energy/lb |
| Corn (d.m.)       | 7,000 lb/ac and 5,777 kJ digestible energy/lb  |
| Vegetables (d.m.) | 1,300 lb/ac and 7,178 kJ digestible energy/lb  |
| Proc. peas (d.m.) | 450 lb/ac and 6,614 kJ digestible energy/lb    |

<sup>1</sup> The energy equivalents include the energy contained in the crop inputs plus the energy used in processing, refining, formulating, manufacturing, etc., and transportation.

\* Kilojoules.

\*\* Active ingredient.

**Definitions:**

Gross energy: the energy released on combustion of a feed.

Digestible energy: gross energy, less energy in feces.

Metabolizable energy: digestible energy less energy in urine and combustible gases.

Net energy: metabolizable energy less energy lost as heat (specific dynamic activity and basal metabolism).

# AGRICULTURAL PRODUCTIVITY IN EASTERN CANADA



D.M. Shute\*

## INTRODUCTION

Productivity is a key indicator of performance in any industry, measuring the efficiency with which production inputs are transformed into outputs and distributed to markets. Higher productivity means potential for higher income for industries and individuals and contributes significantly to the economy of a country.

During the 1962-74 period, agricultural productivity increased at a higher rate in Eastern Canada than in the West<sup>1</sup>. This was due partly to changes in the Maritimes, where there was a large decrease in input use, mainly labor. Maritime agriculture had been slower than other regions in adopting new technology prior to 1962; since then, capital began to replace labor at a faster pace and productivity increased at a higher rate than in other regions. However, regions like Ontario had already increased productivity considerably prior to 1962, with the result that there was less potential for growth in succeeding years.

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<sup>1</sup>D.M. Shute, "National and Regional Productivity of Canadian Agriculture, 1961 to 1974". Canadian Farm Economics, Vol. 10, No. 6, Dec. 1975.

*Agricultural productivity in the Maritime Provinces increased .9 percent annually between 1962 and 1974, mainly because labor inputs decreased 6 percent annually. Inputs as a whole decreased .8 percent annually while output rose only .03 percent annually.*

*Productivity in Ontario rose .7 percent per year and in Quebec .4 percent. Labor decreased at slower rates than in the Maritimes during the period because in these two provinces capital had already replaced labor to a large degree prior to 1962.*

This article discusses the changes in productivity in the various regions in Eastern Canada and the trends in input use and output contributing to the changes. Ontario, Quebec and the Maritimes (Nova Scotia, New Brunswick and Prince Edward Island) are the regions studied.

## PRODUCTIVITY MEASUREMENT

For purposes of this article productivity is defined as total farm output per unit of total production inputs. Inputs and output are valued at 1961 prices. This removes the effects of price changes over time resulting in a measure of the relative changes in real output and inputs (total real costs of production). In measuring production inputs, an attempt was made to take into account all factors of production, both those provided by the farm sector<sup>2</sup> and those purchased from the non-farm sector<sup>3</sup>.

<sup>2</sup>Includes interest on investment and depreciation of real estate and machinery, operator and family labor as well as interest on investment in livestock.

<sup>3</sup>Building and machinery repair, hired labor, purchased feed, seed, fertilizer and other inputs such as insurance, pesticides, twine, etc.

In measuring output there is the problem of the wide year-to-year fluctuations that can occur in the volume of production, particularly of crops. These fluctuations, usually attributable to weather, must be kept in mind when using productivity indexes. For example, although there may be potential for increased output through increased inputs, unfavorable weather can restrict output, thus lowering productivity. Since grain production is a very important part of Canadian farm output, unfavorable weather on the prairies can significantly affect the productivity index for Canada as a whole, not to mention the index for Western Canada<sup>4</sup>. In general, however, the larger the aggregation of output in terms of crops and area of production considered, the smaller is the effect of fluctuations in output of any one crop or region.

## TYPES OF FARMS IN EASTERN CANADA

Mixed farming, with major emphasis on hogs, dairy products and potatoes, predominates in Prince Edward Island, where about 55 percent of the land was classed as farmland in the 1971 census. Of census farms<sup>5</sup>, 35 percent were livestock (cattle, hogs or sheep), 23 percent dairy and 22 percent field crops.

In Nova Scotia farmland accounts for only 10 percent of the land area. Forty percent of farms are dairy and 26 percent are livestock.

In New Brunswick, 8 percent of the land is in farms. Dairy farms are 32 percent of farms, field crops 26 percent and livestock about 20 percent.

The majority of farms in Ontario and Quebec are either dairy or livestock. In Quebec 70 percent of farms are dairy and 13 percent livestock. In Ontario 27 percent are dairy and 43 percent livestock.

## MARITIMES

Agricultural output in the Maritime region remained fairly constant between 1962 and 1974, with an overall annual growth rate of .03 percent (Table 1, Figure 1).

Prince Edward Island and Nova Scotia increased farm output at annual rates of .4 and .5 percent, respectively, but there was a negative annual growth rate of .7 percent in New Brunswick. The output growth rate in the Maritimes failed to keep pace with the rate for Canada, which was 1.2 percent annually. The Maritime environment, both physical and economic, and the traditional aspects of land settlement may have prevented farm output from increasing at as fast a rate as in the rest of Canada. The distant location of much of the farmland in the region from main market centres in central Canada or transportation arteries and limited local market opportunities may also have been a deterrent to increased agricultural production.

The general economic position of farming in the Maritimes can be portrayed by the changes that occurred from 1961 to 1971. The number of census farms decreased 49 percent in that period<sup>6</sup> compared with 24 percent for Canada, while the total area of farms declined 36 percent compared with 1.7 percent for Canada. In the Maritimes the largest decrease in number of farms occurred in New Brunswick, while the largest decrease in area of farmland was in Nova Scotia. Between 1961 and 1966 the number of farms in the Maritimes decreased 22 percent and total land area only 15 percent. From 1966 to 1971, however, the rates increased, with farm numbers declining 35 percent and land area 25 percent<sup>7</sup>. By adopting new technology earlier the other regions lowered their per unit real costs, further weakening the already poor competitive position of Maritime agriculture.

A notable change in the Maritimes between 1961 and 1971 was a 24-percent decrease in acreage of improved land. In 1971 about 40 percent of the farmland was improved compared with about 64 percent for Canada. There are several reasons for the large proportion of unimproved farmland in the Maritimes, including the poor quality of the land, its relatively high cost of improvement and the lack of market opportunities for high value crops.

The Maritime region was the only one in Canada where agricultural input use decreased between 1962 and 1974.

<sup>4</sup> This is the reason that in this article trends are studied between 1962 and 1974. Output of grains from the Prairie region, which has a significant effect on the total output index, was greatly reduced as a result of drought in 1961. Thus, much of the gain in output between 1961 and 1974 was due to the 28-percent increase from 1961 to 1962. Although output in the East is not affected as seriously by weather as output from the West, trends for the East are studied from 1962 to 1974 for consistency.

<sup>5</sup> All census farms, with the exception of "institutional farms, etc.", with sales of \$2,500 or more.

<sup>6</sup> Statistics Canada, *Census of Agriculture, 1971*.

<sup>7</sup> Relative to the decline in farm numbers, the increase in average farm size in the Maritimes was lower than for Canada as a whole, indicating that proportionately more farms were abandoned there.

TABLE 1. INDEXES OF OUTPUT, INPUTS AND PRODUCTIVITY (OUTPUT PER UNIT OF INPUT), EASTERN CANADIAN AGRICULTURE BY REGION, 1961 TO 1974 (1961=100)

|                      | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | Annual Growth Rates <sup>a</sup> |       |
|----------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|----------------------------------|-------|
| FARM OUTPUT          |      |      |      |      |      |      |      |      |      |      |      |      |      |      |                                  |       |
| Prince Edward Island | 100  | 98   | 102  | 107  | 107  | 116  | 113  | 115  | 121  | 118  | 108  | 101  | 103  | 112  | .60                              | .40   |
| Nova Scotia          | 100  | 102  | 101  | 98   | 99   | 103  | 106  | 108  | 109  | 107  | 106  | 104  | 101  | 107  | .50                              | .50   |
| New Brunswick        | 100  | 101  | 98   | 99   | 97   | 104  | 98   | 105  | 100  | 92   | 96   | 94   | 89   | 95   | -.70                             | -.70  |
| Maritimes            | 100  | 101  | 100  | 100  | 100  | 106  | 105  | 108  | 108  | 104  | 103  | 99   | 97   | 104  | .10                              | .03   |
| Quebec               | 100  | 105  | 105  | 103  | 104  | 109  | 113  | 118  | 117  | 118  | 117  | 109  | 111  | 117  | 1.05                             | .94   |
| Ontario              | 100  | 105  | 106  | 109  | 109  | 118  | 115  | 118  | 118  | 125  | 126  | 127  | 122  | 133  | 1.93                             | 1.83  |
| CANADA               | 100  | 128  | 140  | 130  | 137  | 155  | 135  | 145  | 150  | 138  | 157  | 149  | 157  | 150  | 2.04                             | 1.25  |
| PRODUCTION INPUTS    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |                                  |       |
| Prince Edward Island | 100  | 92   | 87   | 93   | 94   | 98   | 98   | 95   | 99   | 102  | 97   | 92   | 96   | 101  | .40                              | .70   |
| Nova Scotia          | 100  | 93   | 86   | 91   | 90   | 90   | 84   | 85   | 84   | 86   | 86   | 83   | 98   | 93   | -.60                             | -.30  |
| New Brunswick        | 100  | 89   | 79   | 81   | 81   | 79   | 73   | 69   | 68   | 67   | 62   | 63   | 66   | 68   | -3.0                             | -2.60 |
| Maritimes            | 100  | 91   | 83   | 88   | 87   | 87   | 83   | 81   | 81   | 82   | 79   | 77   | 81   | 85   | -1.17                            | -.82  |
| Quebec               | 100  | 100  | 100  | 98   | 100  | 100  | 105  | 105  | 102  | 103  | 101  | 104  | 105  | 107  | .48                              | .52   |
| Ontario              | 100  | 100  | 106  | 106  | 107  | 108  | 113  | 112  | 113  | 113  | 114  | 113  | 117  | 117  | 1.16                             | 1.09  |
| CANADA               | 100  | 101  | 102  | 104  | 104  | 105  | 109  | 109  | 109  | 109  | 111  | 113  | 115  | 119  | 1.20                             | 1.21  |
| PRODUCTIVITY         |      |      |      |      |      |      |      |      |      |      |      |      |      |      |                                  |       |
| Prince Edward Island | 100  | 106  | 117  | 115  | 114  | 118  | 115  | 121  | 122  | 116  | 111  | 110  | 107  | 111  | .20                              | .20   |
| Nova Scotia          | 100  | 110  | 117  | 108  | 110  | 114  | 126  | 127  | 130  | 124  | 123  | 125  | 115  | 115  | 1.10                             | .70   |
| New Brunswick        | 100  | 114  | 124  | 122  | 120  | 132  | 134  | 152  | 147  | 137  | 155  | 149  | 135  | 140  | 2.40                             | 1.90  |
| Maritimes            | 100  | 111  | 120  | 114  | 115  | 122  | 127  | 133  | 133  | 127  | 130  | 129  | 120  | 122  | 1.29                             | .86   |
| Quebec               | 100  | 105  | 105  | 105  | 104  | 109  | 108  | 112  | 115  | 115  | 116  | 105  | 106  | 109  | .58                              | .42   |
| Ontario              | 100  | 105  | 100  | 103  | 102  | 109  | 102  | 105  | 104  | 111  | 110  | 112  | 108  | 113  | .75                              | .72   |
| CANADA               | 100  | 127  | 137  | 125  | 132  | 148  | 124  | 133  | 137  | 127  | 142  | 132  | 136  | 126  | .84                              | .04   |

<sup>a</sup>All growth rates were calculated by fitting an exponential trend line to the index numbers, using the least squares method and then using the compound interest formula.

Source: Based on Statistics Canada data.

## INDEXES OF FARM OUTPUT, EASTERN CANADA, 1961 TO 1974

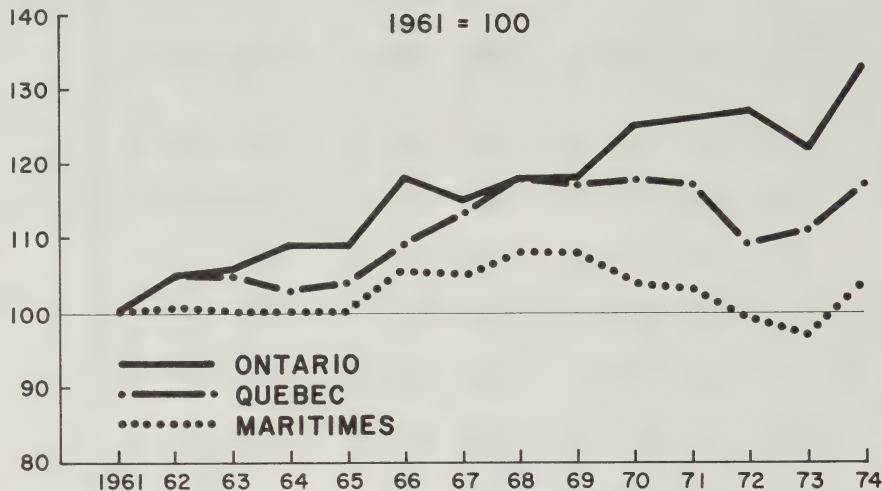


Figure 1

This was probably indicative of the large decrease in number of farms and hence operator and family labor. If non-purchased labor (i.e., operator and family) are excluded, agricultural input use actually increased in the Maritimes.

Real estate inputs, comprising investment in land and buildings and associated costs (depreciation, repairs, taxes, etc.), decreased in the Maritimes since 1962 at the rate of .8 percent annually (Table 2). Decreases in New Brunswick and Nova Scotia offset an increase in Prince Edward Island. In both Nova Scotia and New Brunswick, building repairs and property taxes decreased. While real estate inputs generally declined, their share of total inputs remained fairly constant at 18 percent. They are more important in the total Canadian picture, with a share of about 28 percent.

Labor inputs, comprising hired and non-hired labor, decreased 6 percent annually (Table 2). The largest decrease occurred in New Brunswick, at 8 percent

annually. Unlike Canada as a whole, where a decrease in the labor input of about 3 percent annually was matched by a growth in capital<sup>8</sup> of a little more than 3 percent annually, capital inputs in the Maritime region increased only 2.4 percent annually. While this is considerably lower than the rate at which labor declined, it is fairly close to the rate of capital increase on a national basis. This suggests that there had been a considerable surplus of under-employed farm workers in the Maritimes and that after leaving the labor force their effect on output would have gone unnoticed even without an increase in capital. Spurring the labor decrease was a more rapid increase in the price of labor compared with the price of capital inputs. Labor price increases were greater in Eastern Canada than in Western Canada<sup>9</sup>.

<sup>8</sup> All inputs other than labor and real estate.

<sup>9</sup> Farm Input Price Index, Statistics Canada, Cat. No. 62-004, Quarterly.

TABLE 2. INDEXES OF MAJOR INPUTS, EASTERN CANADIAN AGRICULTURE BY REGION, 1961 TO 1974 (1961=100)

| Indexes and Region       | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | Annual Growth Rates <sup>a</sup> |         |
|--------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|----------------------------------|---------|
|                          |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 1961-74                          | 1962-74 |
| Real Estate <sup>a</sup> |      |      |      |      |      |      |      |      |      |      |      |      |      |      |                                  |         |
| Prince Edward Island     | 100  | 104  | 105  | 112  | 115  | 118  | 117  | 124  | 119  | 126  | 121  | 134  | 130  | 139  | 2.20                             | 2.10    |
| Nova Scotia              | 100  | 100  | 99   | 99   | 100  | 101  | 98   | 94   | 94   | 96   | 92   | 95   | 102  | 99   | -.30                             | -.30    |
| New Brunswick            | 100  | 102  | 102  | 99   | 100  | 90   | 76   | 75   | 72   | 73   | 70   | 70   | 73   | 74   | -3.40                            | -3.60   |
| Maritimes                | 100  | 101  | 102  | 102  | 103  | 100  | 93   | 93   | 90   | 93   | 89   | 93   | 96   | 97   | -.78                             | -.84    |
| Quebec                   | 100  | 101  | 101  | 98   | 98   | 101  | 99   | 98   | 96   | 102  | 95   | 98   | 103  | 104  | .06                              | .09     |
| Ontario                  | 100  | 100  | 101  | 101  | 102  | 103  | 105  | 106  | 106  | 104  | 101  | 102  | 102  | 106  | .28                              | .24     |
| CANADA                   | 100  | 101  | 101  | 101  | 102  | 103  | 106  | 109  | 108  | 114  | 115  | 117  | 119  | 124  | 1.68                             | 1.78    |
| LABOR <sup>b</sup>       |      |      |      |      |      |      |      |      |      |      |      |      |      |      |                                  |         |
| Prince Edward Island     | 100  | 83   | 67   | 75   | 67   | 67   | 67   | 58   | 67   | 67   | 58   | 42   | 42   | 50   | -4.90                            | -4.40   |
| Nova Scotia              | 100  | 82   | 64   | 73   | 64   | 59   | 50   | 50   | 45   | 45   | 45   | 36   | 41   | 45   | -6.20                            | -5.50   |
| New Brunswick            | 100  | 76   | 57   | 62   | 57   | 52   | 48   | 38   | 38   | 38   | 29   | 29   | 29   | 29   | -8.70                            | -8.00   |
| Maritimes                | 100  | 80   | 62   | 69   | 62   | 58   | 53   | 47   | 47   | 47   | 72   | 35   | 36   | 40   | -6.68                            | -6.02   |
| Quebec                   | 100  | 96   | 90   | 83   | 84   | 77   | 83   | 88   | 78   | 76   | 71   | 70   | 64   | 62   | -3.12                            | -3.03   |
| Ontario                  | 100  | 98   | 106  | 99   | 93   | 86   | 91   | 88   | 84   | 82   | 83   | 72   | 75   | 74   | -2.67                            | -2.82   |
| CANADA                   | 100  | 97   | 95   | 92   | 87   | 80   | 82   | 80   | 78   | 75   | 75   | 70   | 68   | 74   | -2.75                            | -2.94   |
| CAPITAL <sup>c</sup>     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |                                  |         |
| Prince Edward Island     | 100  | 98   | 103  | 107  | 117  | 126  | 126  | 126  | 129  | 132  | 132  | 135  | 146  | 146  | 3.10                             | 3.10    |
| Nova Scotia              | 100  | 106  | 112  | 115  | 124  | 130  | 128  | 130  | 136  | 138  | 140  | 143  | 148  | 160  | 3.10                             | 2.90    |
| New Brunswick            | 100  | 101  | 98   | 98   | 105  | 109  | 106  | 108  | 108  | 105  | 105  | 107  | 116  | 120  | 1.10                             | 1.20    |
| Maritimes                | 100  | 101  | 104  | 106  | 114  | 120  | 118  | 120  | 123  | 124  | 124  | 127  | 134  | 140  | 2.42                             | 2.40    |
| Quebec                   | 100  | 104  | 109  | 112  | 116  | 122  | 130  | 126  | 130  | 131  | 133  | 141  | 147  | 153  | 3.04                             | 2.95    |
| Ontario                  | 100  | 100  | 108  | 114  | 120  | 126  | 132  | 132  | 135  | 139  | 141  | 146  | 153  | 152  | 3.51                             | 3.32    |
| CANADA                   | 100  | 104  | 110  | 116  | 121  | 129  | 136  | 137  | 138  | 138  | 140  | 148  | 155  | 158  | 3.39                             | 3.23    |

<sup>a</sup>Includes interest on investment, depreciation and repairs on buildings and property taxes for both owned and rented real estate.

<sup>b</sup>Total farm labor force (farm operators, unpaid family labor and hired labor).

<sup>c</sup>All inputs other than real estate and labor.

<sup>d</sup>All growth rates were calculated by fitting an exponential trend line to the index numbers, using the least squares method and then using the compound interest formula.

In 1962 labor's share of total inputs in Maritime agriculture was 42 percent. The share for Canada was 33 percent. In other regions of the country, by 1962, low farm incomes had resulted in a large number of farmers and farm workers leaving their farms for more attractive employment opportunities in urban areas. People in the Maritimes may have remained on their farms longer, despite low incomes, because of the lack of other employment opportunities. The unemployment rate has been consistently highest in the Maritimes (and Newfoundland). Labor adjustment increased considerably in the Sixties, though, and by 1974 labor inputs accounted for about 22 percent of all inputs in the Maritimes compared with 20 percent for Canada.

As mentioned previously, capital inputs increased in the Maritimes at an annual rate of 2.4 percent (Table 2). The increase was greatest in Prince Edward Island, where it exceeded the rate for Canada. Capital growth was slower in the Maritimes principally because it could not keep pace with the sharp decrease in labor inputs. Farmers who remained increased their capital substantially and maintained production. Despite a lower rate of growth for capital, large decreases in labor and real estate inputs resulted in capital's share of total inputs increasing from about 40 percent to 59 percent. By comparison, the contribution of capital to total inputs for Canada in 1974 was about 51 percent. It is interesting that, while New Brunswick had the lowest rate of growth in capital, about 62 percent of total inputs were capital inputs in 1974.

Machinery inputs<sup>10</sup> increased fairly rapidly in the Maritimes, at 2.4 percent annually. Prince Edward Island led with a rate of 3.1 percent. The greatest increases were for machinery repairs. The share of machinery in relation to total inputs increased to 22 percent in 1974 from 15 percent in 1962. For Canada in 1974 the figure was 26 percent.

Livestock inputs (livestock and poultry<sup>11</sup>) in the Maritimes decreased .6 percent per year. They increased in all other provinces.

Reduced crop acreage in the Maritimes may have indirectly affected livestock inputs and output. The impact of reduced acreage was greatest in the reduc-

tion of feed grain and hay production. These decreases, however, were perhaps a result of marginal land going out of production as farm numbers dropped.

Consistent with reduced acreage of feed grains were increases in purchased feed inputs at the rate of 3 percent annually. The fact that livestock inputs decreased slightly while purchased feed inputs increased considerably suggests that feed freight assistance, or perhaps increased specialization, prompted farmers to buy grain rather than grow it, releasing their limited land areas for other purposes. Despite this strong regional growth rate for purchased feed grains, it is still below the national average of about 4.2 percent. The share of purchased feed inputs increased from 11 percent of total inputs in 1962 to about 18 percent in 1974.

Purchased seed and nursery stock inputs showed the highest growth rate of any capital input — about 9.2 percent annually. Their share of total inputs increased from .6 percent to nearly 2 percent.

Fertilizer and lime inputs increased 1.4 percent annually, well below the national growth rate of about 6 percent. Use in Prince Edward Island and Nova Scotia increased 5.2 percent annually, but in New Brunswick use decreased 2.1 percent per year. Fertilizer and lime were about 7 percent of all inputs in 1974 compared with 4 percent of all inputs for Canada.

Farm inputs designated miscellaneous<sup>12</sup> increased 1.9 percent annually. The largest increases were in pesticides and twine. Miscellaneous inputs, as with most other inputs, showed the greatest rate increases in Prince Edward Island.

The net effect of decreased inputs of labor, real estate and livestock in the Maritimes was to reduce total input use .8 percent annually between 1962 and 1974. This decrease in use of farm inputs resulted in productivity increasing .9 percent annually, despite an annual increase in agricultural output of only .03 percent (Figure 2, Table 1). The Maritime Provinces maintained their 1962 level of output despite the large decrease in farm numbers and area, indicating that it was the poorer agricultural areas that were abandoned or diverted to non-farm use.

<sup>10</sup> Interest on investment and depreciation, fuel, lubrication and maintenance costs.

<sup>11</sup> Includes interest on investment in livestock and livestock purchases, and associated costs.

<sup>12</sup> Includes electric power, pesticides, twine, containers and other purchased inputs not elsewhere specified.

## QUEBEC

Agricultural productivity in Quebec increased .4 percent annually (Table 1, Figure 2). This was a result of output increasing .9 percent and inputs .5 percent annually.

Quebec, like the Maritimes, increased its agricultural output despite large decreases in the number of farms since 1961. The number of census farms in Quebec decreased about 36 percent between 1961 and 1971 while the total area in farms decreased about 24 percent. In 1971, only 3.2 percent of Quebec land was used for farming. (British Columbia is the only region with proportionately less farmland). Average farm size increased only 19 percent in Quebec between 1961 and 1971 compared with 29 percent for Canada as a whole and 26 percent in the Maritimes.

The acreage of improved land in Quebec decreased 18 percent between 1961 and 1971, but its share of total farmland increased from 55 percent to 60 percent.

Farm real estate inputs increased slightly since 1962, at the annual rate of .1 percent (Table 2). Decreases in land and building investment were slightly more than offset by increases in building maintenance and property taxes. Decreased real estate investment would be more a reflection of the large decrease in acreage of farmland reported than a deterioration of existing farmland and buildings. The relative importance of real estate among total inputs decreased slightly from 19 percent in 1962 to 18 percent in 1974.

Farm labor inputs decreased 3 percent annually, similar to the rate for all of Canada (Table 2). Labor in Quebec, as in the Maritimes, provided a larger share (39 percent) of total inputs than in the rest of Canada during the early sixties. Quebec's generally high rate of unemployment, second only to that of the Maritimes (and Newfoundland), affected the rate of decrease in the agricultural labor force. Lack of alternative employment opportunities, no doubt, tend to slow the exodus from farms. By 1974, labor inputs were 23 percent of total inputs.

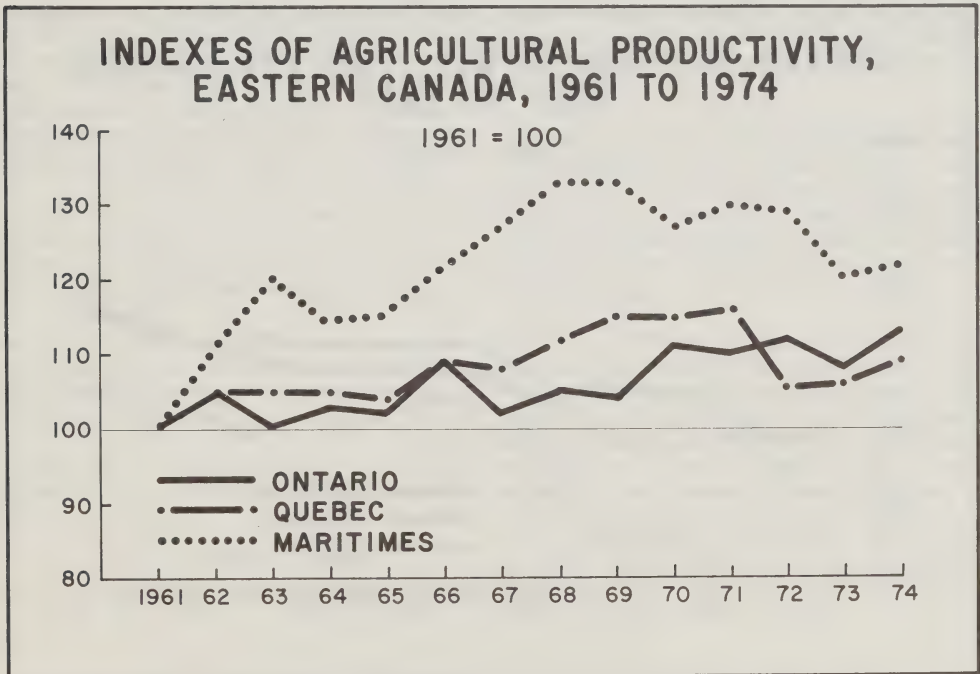


Figure 2

Capital inputs increased 3 percent annually, the rate at which labor declined (Table 2). Capital inputs were 58 percent of all inputs in 1974 compared with 41 percent in 1962.

Machinery inputs showed an annual growth rate of 3 percent. The leading item was machinery repairs.

Livestock inputs increased 1.3 percent per year. Over 80 percent of the farms in Quebec are livestock and dairy farms and there has been a considerable increase in investment in livestock. Artificial insemination expenses have increased sharply as farmers strive to take advantage of genetically superior cattle and eliminate the cost of maintaining breeding sires.

Increases in livestock inputs together with the decreased acreage of feed grains and hay, as in the Maritimes, along with feed freight assistance and increased specialization, resulted in purchased feed inputs increasing about 2.5 percent annually.

Decreases in acreage of feed grains and hay were not as sharp in Quebec as in the Maritimes, which is reflected by the lower rate of growth in purchased feeds.

Purchased seed inputs increased 9 percent annually, the highest growth rate of any input. This was also true for Canada and the Maritimes. Reduced acreages have resulted in larger investments in better quality seed and fertilizer inputs. Fertilizer use increased about 6 percent annually, equal to the national average.

Miscellaneous inputs increased 2 percent per year, with pesticides increasing most rapidly.

## ONTARIO

Farm output in Ontario increased at the highest rate of any province in Eastern Canada between 1962 and 1974, 1.8 percent annually, equalling the Alberta growth rate, the highest in the West (Table 1, Figure 1). Ontario in 1971 had 43 percent of its farms classed as livestock farms. The high output growth rate is understandable because, on a national level between 1962 and 1974, total livestock output increased 2.8 percent annually. Total farm inputs increased at the annual rate of 1.1 percent (Table 1, Figure 3), so that productivity increased .7 percent annually (Table 1, Figure 2).

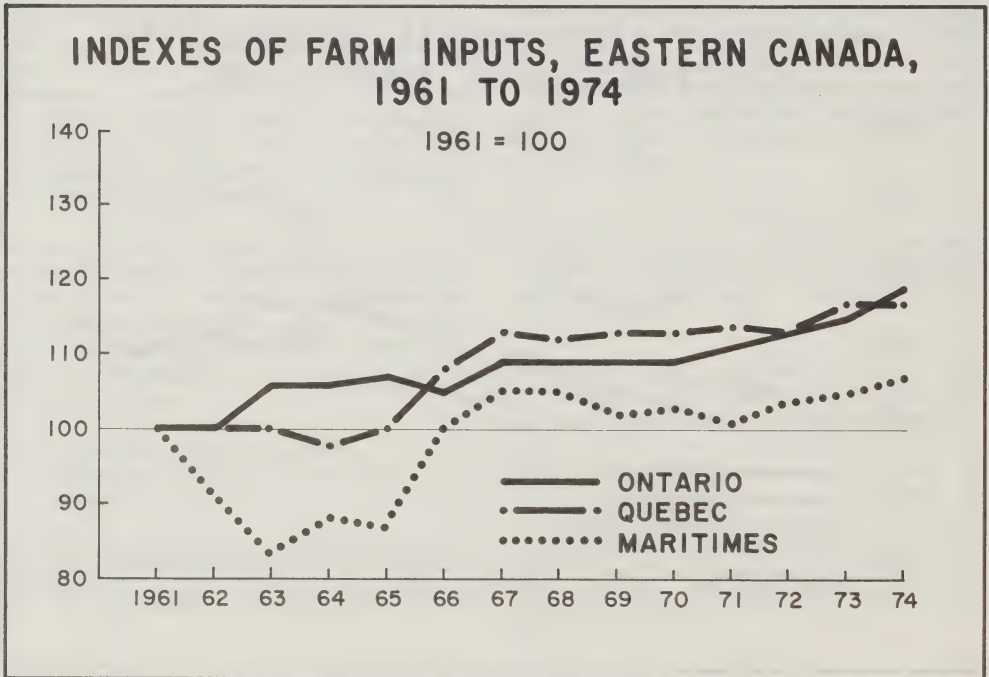


Figure 3

The number of census farms in Ontario decreased from 1961 to 1971 but not as dramatically as in the Maritimes and Quebec. By 1971, the number of farms had declined about 22 percent and total area in farms 14 percent. Of the total land area in 1971, only 7 percent was used for farming. The average farm size was 168 acres, the lowest average of all provinces except Newfoundland.

The number of improved acres dropped 10 percent between 1961 and 1971 but improved acreage in 1971 was 68 percent of total farmland. Saskatchewan was the only province with proportionately more improved farmland.

Real estate inputs increased slightly, .2 percent annually (Table 2). Their share of total inputs decreased from 27 percent to 24 percent.

Labor inputs decreased 2.8 percent annually (Table 2). This was less than the rates of decrease that occurred in the Maritimes and Quebec and almost equal to the national rate of decline. In 1962, farm labor in Ontario was 28 percent of total inputs, the lowest share among regions in Canada. Ontario and the Prairie Provinces in 1962 and all years since have had the lowest unemployment rates in Canada. By 1962 a large number of the low-income farmers and farm workers in Ontario had already left for employment opportunities elsewhere.

Capital inputs increased 3.3 percent annually (Table 2). The relative importance of capital increased from 45 percent of total inputs in 1962 to 58 percent in 1974; this compares with 50 percent for Canada in 1974.

Machinery inputs increased 3.4 percent annually. The greatest increase, as in other regions, was in machinery repairs. Machinery inputs increased from 16 percent of total inputs to 22 percent.

Livestock inputs increased slightly, by .4 percent annually. Their share of total inputs, however, decreased from 4.2 to 3.6 percent.

Purchased feed inputs increased 3.5 percent per year and

their relative importance rose from about 13 to 17 percent.

Purchased seed and nursery stock inputs more than doubled, increasing at the annual rate of 10.2 percent. Fertilizer use increased 3.3 percent annually.

Miscellaneous inputs increased 2.3 percent annually. Pesticides and twine use showed the largest increases in this category.

## SUMMARY

The Maritimes had the highest rate of productivity growth between 1962 and 1974 among the three eastern regions (Ontario, Quebec and the Maritimes), .9 percent annually. This was not the result of significantly increased output — it increased only .03 percent annually — but rather of farm inputs decreasing .82 percent per year. The leading factor was labor, which decreased 6 percent annually. The replacement of labor with capital, which had occurred to a large extent in other regions prior to 1962, did not become widespread in the Maritimes until after 1962. The growth in capital inputs was only 2.4 percent annually, well below the decline in labor inputs. Real estate inputs declined .8 percent annually.

Productivity in Quebec increased .4 percent annually with farm input use rising .5 percent and farm output nearly 1 percent. Unlike the Maritimes, capital input growth (3 percent) matched the decline in labor inputs. This partly explains the higher rate of growth in output in Quebec than in the Maritimes. Real estate inputs rose .1 percent per year.

Productivity in Ontario rose .7 percent annually. Output increased at the highest rate of all eastern regions, 1.8 percent. Farm inputs in Ontario also increased at the highest rate for the East, 1.1 percent. Capital inputs increased 3.3 percent annually, exceeding the 2.9-percent annual decline in labor inputs. Real estate inputs increased .2 percent annually. However, productivity in Ontario did not increase as fast as it did in the Maritimes because new technology had already been adopted prior to 1962, leaving less potential for improvement after 1962.

# CHANGES IN FOOD EXPENDITURE PATTERNS, 1969-1974



D.T. Karamchandani\*

*Considerable changes in the Canadian food expenditure pattern occurred during the 1969-74 period. Consumers (especially those in high-income groups) preferred to eat out more often in 1974 and to increase their expenditures on frozen food more than on meat, fruit and vegetables, which are among the most important items in the Canadian diet.*

## INTRODUCTION

The consumer price index for food rose 48.3 percent between 1969 and 1974, while per capita expenditure for food increased 48.4 percent (Table 5). An earlier study<sup>1</sup> showed that per capita consumption of all foods taken together had changed very little during the same period. This suggests that increases in expenditures for food were due mainly to higher prices.

The purpose of this article is to examine, using food survey data, food expenditure patterns of urban families in Canada to determine what changes have occurred between 1969 and 1974<sup>2</sup>. To achieve this purpose a study is done of changes in weekly food expenditure,

changes in expenditure shares by commodity group, per capita expenditures by income level<sup>3</sup>, and changes in food prices, consumption and expenditures for individual commodities.

## DATA

The data on food expenditures and consumption<sup>4</sup> are from Statistics Canada's "1969 Family Food Expenditure Survey" and "1974 Urban Family Food Expenditure Survey". Families and unattached individuals living in private households in 14 major cities were asked to record, over a period of two consecutive weeks, the food items they bought, the quantity and the amount spent on each item. These surveys were taken monthly, involving different samples of families and individuals.

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<sup>1</sup>D.T. Karamchandani, "Trends in Food Consumption, Prices and Expenditures, 1961-73", Canadian Farm Economics, Volume 11, No. 1, February 1976, pp. 17-26.

<sup>2</sup>Readers interested in detailed statistical tests or measures of income-expenditure and price-quantity relationships should refer to Urban Food Consumption Patterns in Canada, by Z.A. Hassan and S.R. Johnson, forthcoming publication, Economics Branch, Agriculture Canada, Ottawa.

<sup>3</sup>Participants in the surveys were asked to state their incomes. The samples were then divided into five groups, or quintiles, each representing an income category. The first quintile is the lowest-income category and the fifth is the highest.

<sup>4</sup>Quantity consumed means quantity purchased by the consumers.

Retail price indexes (1971 = 100) were obtained from Statistics Canada's "Prices and Price Indexes", Catalogue No. 62-002. The Consumer Price Index records the percentage change in the cost of a constant basket of goods and services purchased by a particular group in a specified time period. The CPI population reference group for Canada includes<sup>5</sup>: those living in Canadian urban centers with metropolitan populations exceeding 30,000; those families ranging in size from two to six persons, consisting of any combination of adults or of adults and children; and those with annual incomes in 1969 ranging from \$4,000 to \$12,000.

## CHANGES IN WEEKLY FOOD EXPENDITURES

Between 1969 and 1974 the average weekly total food expenditure<sup>6</sup> per family in the samples increased from \$29.23 to \$40.80, as shown in the first two columns of Table 1. Expenditure on food at home increased from \$22.79 to \$30.56, while food away from home increased from \$6.44 to \$10.23.

Per capita food expenditure rose more than 48 percent, from \$9.13 to \$13.55, as shown in the first two columns of Tables 2 and 3. The amount for food at home rose 43 percent, from \$7.12 to \$10.15, while that for food away from home increased 69 percent, from \$2.01 to \$3.40.

Although the increase in food expenditures appears to be large, expenditures on other goods and services such as shelter, travel and transportation and recreation rose much faster over the same period.<sup>7</sup>

## CHANGES IN EXPENDITURE SHARES BY COMMODITY GROUP

According to the survey data (Table 4 and Figure 1), an average Canadian in 1974 was spending more of his food dollar on food away from home, with the share rising from 22 to 25 percent<sup>8</sup>. The share of food at home correspondingly dropped from 78 to 75 percent.

The data also show expenditure shares of the various commodity groups in relation to total expenditures. On average, the share for meat and poultry in 1974 was 24.85 (25.24 percent)<sup>9</sup>. It was followed by fruits and vegetables at 11.65 (12.78), dairy products at 10.41 (12.00), cereal and bakery products at 8.38 (9.33), miscellaneous groceries 6.22 (5.57) and beverages 4.16 (4.27). The lesser expenditure items are eggs, fish, fats and oils, prepared dishes and frozen food.

The expenditure shares of meat and poultry, fruits and vegetables, dairy products and cereal and bakery products are declining, while the shares of fish, fats and oils, miscellaneous groceries and frozen food are following an upward trend.

## PER CAPITA EXPENDITURES BY INCOME QUINTILE

The following section discusses the effect of income on the buying habits of Canadians. Supporting data can be found in Table 2 and Figures 3 to 8<sup>10</sup>.

In both years, as a result of higher income, there was a steadily rising expenditure on food away from home (Figure 3). However, expenditures on food at home were very stable, suggesting that changes in total food expenditure from one quintile to the next are due to changes in expenditures on food away from home.

Consumers in the higher-income quintiles appear to spend more on red meat than do consumers in the lower-income quintiles. However, almost no variation can be observed in the expenditure on fish and poultry (Figure 4).

In 1969 as well as 1974 rising income increases demand for high-quality cuts<sup>11</sup> of beef as shown in Figure 5. Expenditures for medium-quality cuts<sup>12</sup> are also affected, but to a lesser degree. The demand for low-quality cuts is not affected by rising income<sup>13</sup>.

<sup>5</sup> Statistics Canada. The Consumer Price Index for Canada, Cat. No. 62-539, Ottawa, 1973, p. 6.

<sup>6</sup> Data on weekly food expenditure are expressed in terms of current dollars.

<sup>7</sup> For more detailed information see the section on family expenditure in the "Handbook on Food Expenditures, Prices and Consumption," by Z.A. Hassan and D. Karamchandani, Economics Branch, Agriculture Canada, Publication No. 76/5, June 1976.

<sup>8</sup> Because the method of collecting data on food away from home was different in the two surveys, restraint must be used in drawing conclusions.

<sup>9</sup> 1969 figures are in parentheses.

<sup>10</sup> Although expenditure data are not continuous between income quintiles, the type of figure used in this article has been preferred because of clarity and ease of interpretation.

<sup>11</sup> High-quality cuts of beef, or hind quarters, include: loin, round and rib cuts.

<sup>12</sup> Medium-quality cuts of beef, or front quarters, include: shoulder, brisket and flank cuts.

<sup>13</sup> Low-quality cuts of beef, or manufacturing, include: stewing beef, hamburger, minced beef and others.

TABLE 1. PER FAMILY WEEKLY FOOD EXPENDITURES BY INCOME QUINTILE, 1969 and 1974

| Family Characteristics      | All Classes |          | First   |         | Second  |         | Third   |          | Fourth  |          | Fifth    |           | Not Stated |       |
|-----------------------------|-------------|----------|---------|---------|---------|---------|---------|----------|---------|----------|----------|-----------|------------|-------|
|                             | 1969        | 1974     | 1969    | 1974    | 1969    | 1974    | 1969    | 1974     | 1969    | 1974     | 1969     | 1974      | 1969       | 1974  |
| Family Size                 | 3.2         | 3.01     | 1.7     | 1.745   | 2.95    | 2.59    | 3.45    | 3.30     | 3.7     | 3.49     | 4.15     | 3.885     | 3.1        | 3.10  |
| Net Income Before Taxes     | 8,700.4     | 12,370.3 | 2,240.3 | 3,772.1 | 5,248.8 | 7,934.6 | 7,417.3 | 11,260.5 | 9,877.6 | 14,999.7 | 16,620.1 | 23,884.35 | —          | —     |
|                             | 1969        | 1974     | 1969    | 1974    | 1969    | 1974    | 1969    | 1974     | 1969    | 1974     | 1969     | 1974      | 1969       | 1974  |
| Dairy Products              | 3.51        | 4.25     | 1.76    | 2.42    | 3.02    | 3.55    | 3.89    | 4.58     | 4.10    | 5.13     | 4.81     | 5.56      | 3.39       | 4.32  |
| Fresh Milk                  | 1.75        | 2.05     | .80     | 1.11    | 1.52    | 1.66    | 2.02    | 2.35     | 2.06    | 2.50     | 2.40     | 2.61      | 1.68       | 2.13  |
| Other Milk Products         | 1.75        | 2.20     | .97     | 1.31    | 1.50    | 1.90    | 1.88    | 2.24     | 2.04    | 2.64     | 2.41     | 2.94      | 1.71       | 2.19  |
| Eggs                        | .67         | .74      | .40     | .48     | .60     | .65     | .76     | .80      | .79     | .87      | .81      | .93       | .65        | .78   |
| Bakery Products             | 2.20        | 2.51     | 1.20    | 1.47    | 2.00    | 2.09    | 2.47    | 2.68     | 2.57    | 3.04     | 2.81     | 3.28      | 2.17       | 2.58  |
| Cereals                     | .53         | .91      | .27     | .58     | .47     | .78     | .64     | 1.01     | .62     | 1.05     | .65      | 1.13      | .62        | .92   |
| Meat and Poultry            | 7.38        | 10.14    | 3.56    | 5.77    | 6.55    | 8.21    | 7.95    | 10.40    | 8.90    | 12.19    | 9.84     | 13.71     | 7.98       | 11.87 |
| Beef                        | 3.43        | 4.69     | 1.61    | 2.50    | 2.98    | 3.65    | 3.59    | 4.80     | 4.40    | 5.70     | 4.51     | 6.41      | 3.86       | 6.31  |
| Pork                        | 1.89        | 2.41     | .92     | 1.41    | 1.73    | 2.06    | 1.99    | 2.34     | 2.28    | 2.96     | 2.52     | 3.33      | 1.92       | 2.35  |
| Other Meat                  | 1.05        | 1.58     | .50     | .92     | .94     | 1.30    | 1.32    | 1.77     | 1.11    | 1.86     | 1.42     | 2.03      | 1.01       | 1.65  |
| Poultry                     | 1.01        | 1.46     | .53     | .95     | .91     | 1.21    | 1.05    | 1.49     | 1.12    | 1.68     | 1.40     | 1.94      | 1.18       | 1.57  |
| Fish                        | .50         | .77      | .25     | .52     | .40     | .59     | .51     | .72      | .54     | .90      | .77      | 1.04      | .67        | 1.10  |
| Fats and Oils               | .40         | .84      | .23     | .49     | .37     | .73     | .46     | .99      | .45     | .96      | .47      | 1.06      | .39        | .83   |
| Beverages                   | 1.25        | 1.70     | .74     | 1.10    | 1.11    | 1.51    | 1.35    | 1.82     | 1.42    | 1.89     | 1.64     | 2.19      | 1.34       | 1.67  |
| Miscellaneous Groceries     | 1.63        | 2.54     | .85     | 1.56    | 1.55    | 2.19    | 1.85    | 2.79     | 1.82    | 3.05     | 2.11     | 3.12      | 1.63       | 2.55  |
| Canned and Dried Fruits     | .56         | .65      | .33     | .41     | .48     | .54     | .57     | .67      | .66     | .71      | .76      | .92       | .55        | .74   |
| Canned and Dried Vegetables | .60         | .63      | .32     | .38     | .55     | .55     | .68     | .62      | .71     | .78      | .62      | .85       | .58        | .62   |
| Fresh Fruits                | 1.33        | 1.65     | .78     | 1.03    | 1.12    | 1.55    | 1.30    | 1.65     | 1.68    | 1.85     | 1.70     | 2.16      | 1.70       | 1.82  |
| Fresh Vegetables            | 1.25        | 1.83     | .72     | 1.18    | 1.10    | 1.72    | 1.24    | 1.71     | 1.43    | 2.12     | 1.73     | 2.37      | 1.46       | 2.02  |
| Frozen Food                 | .39         | .67      | .16     | .27     | .29     | .52     | .35     | .71      | .48     | .82      | .72      | 1.03      | .33        | .65   |
| Prepared Food               | .56         | .73      | .32     | .43     | .49     | .61     | .57     | .78      | .63     | .88      | .82      | .96       | .60        | .77   |
| Food at Home                | 22.79       | 30.56    | 11.88   | 18.05   | 20.08   | 25.76   | 24.56   | 31.92    | 26.78   | 36.19    | 30.35    | 40.27     | 24.05      | 33.24 |
| Food Away From Home         | 6.44        | 10.23    | 3.32    | 4.39    | 5.24    | 6.72    | 5.51    | 9.98     | 6.88    | 11.90    | 11.64    | 17.78     | 5.24       | 12.01 |
| Total Food                  | 29.23       | 40.80    | 15.20   | 22.44   | 25.32   | 32.47   | 30.07   | 41.89    | 33.66   | 48.09    | 41.99    | 58.05     | 29.29      | 45.25 |

Source: Statistics Canada, 1969 Family Food Expenditure Survey, Selected Data, Ottawa, January, 1976.

Statistics Canada, 1974 Urban Family Food Expenditure Survey, Selected Data, Ottawa, January, 1976.

TABLE 2. PER CAPITA WEEKLY FOOD EXPENDITURES BY INCOME QUINTILE, 1969 and 1974

|                             | All Classes |       | First |       | Second |        | Third |       | Fourth |       | Fifth |       | Not Stated |       |
|-----------------------------|-------------|-------|-------|-------|--------|--------|-------|-------|--------|-------|-------|-------|------------|-------|
|                             | 1969        | 1974  | 1969  | 1974  | 1969   | 1974   | 1969  | 1974  | 1969   | 1974  | 1969  | 1974  | 1969       | 1974  |
|                             |             |       |       |       |        | — \$ — |       |       |        |       |       |       |            |       |
| Dairy Products              | 1.10        | 1.41  | 1.02  | 1.41  | 1.02   | 1.37   | 1.13  | 1.39  | 1.11   | 1.47  | 1.16  | 1.42  | 1.09       | 1.39  |
| Fresh Milk                  | .55         | .68   | .46   | .64   | .51    | .64    | .58   | .71   | .56    | .71   | .58   | .67   | .54        | .69   |
| Other Dairy Products        | .55         | .73   | .57   | .76   | .51    | .73    | .54   | .68   | .55    | .76   | .58   | .76   | .55        | .71   |
| Eggs                        | .21         | .25   | .24   | .28   | .20    | .25    | .22   | .24   | .21    | .25   | .19   | .24   | .21        | .25   |
| Bakery Products             | .69         | .83   | .70   | .85   | .68    | .81    | .72   | .81   | .69    | .87   | .68   | .84   | .70        | .83   |
| Cereals                     | .17         | .30   | .16   | .34   | .16    | .30    | .19   | .31   | .17    | .30   | .16   | .29   | .20        | .30   |
| Meat and Poultry            | 2.31        | 3.37  | 2.07  | 3.29  | 2.23   | 3.17   | 2.31  | 3.15  | 2.41   | 3.49  | 2.37  | 3.53  | 2.57       | 3.83  |
| Beef                        | 1.07        | 1.56  | .94   | 1.42  | 1.01   | 1.41   | 1.04  | 1.46  | 1.19   | 1.63  | 1.08  | 1.65  | 1.25       | 2.04  |
| Pork                        | .59         | .80   | .54   | .81   | .59    | .79    | .58   | .71   | .62    | .85   | .61   | .86   | .62        | .76   |
| Other Meat                  | .33         | .52   | .29   | .51   | .32    | .50    | .38   | .54   | .30    | .53   | .34   | .52   | .33        | .53   |
| Poultry                     | .32         | .49   | .31   | .55   | .31    | .47    | .31   | .45   | .30    | .48   | .34   | .50   | .38        | .51   |
| Fish                        | .16         | .26   | .15   | .30   | .14    | .23    | .15   | .22   | .15    | .26   | .18   | .27   | .22        | .35   |
| Fats and Oils               | .13         | .28   | .13   | .28   | .13    | .28    | .13   | .30   | .12    | .28   | .11   | .27   | .13        | .27   |
| Beverages                   | .39         | .56   | .44   | .63   | .38    | .58    | .39   | .55   | .38    | .54   | .39   | .56   | .43        | .54   |
| Miscellaneous Groceries     | .51         | .84   | .50   | .90   | .52    | .84    | .53   | .84   | .49    | .87   | .51   | .80   | .53        | .82   |
| Canned and Dried Fruits     | .18         | .22   | .19   | .24   | .16    | .21    | .16   | .20   | .18    | .20   | .18   | .24   | .18        | .24   |
| Canned and Dried Vegetables | .19         | .21   | .19   | .22   | .19    | .21    | .20   | .19   | .19    | .22   | .18   | .22   | .19        | .20   |
| Fresh Fruits                | .42         | .55   | .45   | .60   | .38    | .50    | .38   | .50   | .46    | .53   | .41   | .56   | .55        | .59   |
| Fresh Vegetables            | .39         | .61   | .42   | .68   | .37    | .66    | .36   | .52   | .39    | .61   | .41   | .61   | .47        | .65   |
| Frozen Food                 | .12         | .22   | .09   | .15   | .09    | .20    | .10   | .22   | .13    | .23   | .17   | .26   | .11        | .21   |
| Prepared Food               | .18         | .24   | .19   | .24   | .16    | .23    | .16   | .23   | .17    | .25   | .20   | .25   | .19        | .25   |
| Food at Home                | 7.12        | 10.15 | 6.95  | 10.42 | 6.81   | 9.94   | 7.13  | 9.67  | 7.24   | 10.37 | 7.31  | 10.36 | 7.76       | 10.72 |
| Food Away From Home         | 2.01        | 3.40  | 2.01  | 2.55  | 1.81   | 2.59   | 1.60  | 3.01  | 1.86   | 3.41  | 2.79  | 4.55  | 1.69       | 3.87  |
| Total Food                  | 9.13        | 13.55 | 8.96  | 12.97 | 8.62   | 12.53  | 8.73  | 12.68 | 9.10   | 13.78 | 10.10 | 14.91 | 9.45       | 14.60 |

Source: Table 1

**TABLE 3. PERCENT CHANGE IN PER CAPITA FOOD EXPENDITURE BY INCOME QUINTILE, 1969 and 1974**

|                                  | All Classes  | First        | Second       | Third        | Fourth       | Fifth        | Not Stated   |
|----------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Dairy Products                   | 28.18        | 38.24        | 34.31        | 23.01        | 32.43        | 22.41        | 27.52        |
| Milk                             | 23.64        | 39.13        | 25.49        | 22.41        | 26.79        | 45.52        | 27.78        |
| Other Dairy Products             | 32.73        | 33.33        | 43.14        | 25.93        | 38.18        | 31.03        | 29.09        |
| Eggs                             | 19.05        | 16.67        | 25.00        | 9.09         | 19.05        | 26.32        | 19.05        |
| Bakery Products                  | 20.29        | 21.43        | 19.12        | 12.50        | 26.09        | 23.53        | 18.57        |
| Cereals                          | 76.47        | 112.50       | 87.50        | 63.16        | 76.47        | 81.25        | 50.00        |
| Meat and Poultry                 | 45.89        | 58.94        | 42.15        | 36.36        | 44.81        | 48.95        | 49.03        |
| Beef                             | 45.79        | 51.06        | 39.60        | 40.38        | 36.97        | 52.78        | 63.20        |
| Pork                             | 35.59        | 50.00        | 33.90        | 22.41        | 37.09        | 40.98        | 22.58        |
| Other Meats                      | 57.57        | 75.86        | 56.25        | 42.11        | 76.67        | 52.94        | 60.61        |
| Poultry                          | 53.13        | 77.42        | 51.61        | 45.16        | 60.00        | 47.06        | 34.21        |
| Fish                             | 62.50        | 100.00       | 64.29        | 46.67        | 73.33        | 50.00        | 59.09        |
| Fats and Oils                    | 115.38       | 115.38       | 115.38       | 130.77       | 133.33       | 145.45       | 107.69       |
| Beverages                        | 43.59        | 43.18        | 52.63        | 41.03        | 42.11        | 43.58        | 25.58        |
| Miscellaneous Groceries          | 64.71        | 80.00        | 61.54        | 58.49        | 77.55        | 56.86        | 54.72        |
| Canned and Dried Fruits          | 22.22        | 26.32        | 31.25        | 25.00        | 11.11        | 33.33        | 33.33        |
| Canned and Dried Vegetables      | 10.53        | 15.79        | 10.53        | -5.00        | 15.78        | 22.22        | 5.26         |
| Fresh Fruits                     | 30.95        | 33.33        | 57.89        | 31.58        | 15.22        | 36.58        | 7.27         |
| Fresh Vegetables                 | 56.41        | 61.90        | 78.38        | 44.44        | 56.41        | 48.78        | 38.30        |
| Frozen Food                      | 83.33        | 66.67        | 122.22       | 120.00       | 76.92        | 52.94        | 90.91        |
| Prepared Food                    | 33.33        | 26.32        | 43.75        | 43.75        | 47.06        | 25.00        | 31.58        |
| Food at Home                     | 42.56        | 49.93        | 45.96        | 35.62        | 43.23        | 41.72        | 38.14        |
| Food Away from Home <sup>a</sup> | 69.15        | 26.87        | 43.09        | 88.12        | 83.33        | 63.08        | 128.99       |
| <b>TOTAL FOOD</b>                | <b>48.41</b> | <b>44.75</b> | <b>45.36</b> | <b>45.24</b> | <b>51.43</b> | <b>47.62</b> | <b>54.50</b> |

<sup>a</sup>Includes board paid by family members.

Source: Table 2

**TABLE 4. FOOD EXPENDITURE SHARES BY INCOME QUINTILE, 1969 and 1974**

|                                  | All Classes   |               | First         |               | Second        |               | Third         |               | Fourth        |               | Fifth         |               |
|----------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
|                                  | 1969          | 1974          | 1969          | 1974          | 1969          | 1974          | 1969          | 1974          | 1969          | 1974          | 1969          | 1974          |
| Dairy Products                   | 12.00         | 10.41         | 11.57         | 10.78         | 11.92         | 10.93         | 12.93         | 10.93         | 12.18         | 10.66         | 11.45         | 9.57          |
| Milk                             | 5.98          | 5.02          | 5.26          | 4.94          | 6.00          | 5.11          | 6.71          | 5.61          | 6.12          | 5.19          | 5.71          | 4.49          |
| Other Dairy Products             | 5.98          | 5.39          | 6.38          | 5.83          | 5.92          | 5.85          | 6.25          | 5.34          | 6.06          | 5.48          | 5.73          | 5.06          |
| Eggs                             | 2.29          | 1.81          | 2.63          | 2.13          | 2.37          | 2.00          | 2.52          | 1.90          | 2.34          | 1.80          | 1.92          | 1.60          |
| Bakery and Cereal Products       | 9.33          | 8.38          | 9.66          | 9.13          | 9.74          | 8.83          | 10.33         | 8.80          | 9.47          | 8.50          | 8.24          | 7.59          |
| Meat and Poultry                 | 25.24         | 24.85         | 23.42         | 25.71         | 25.86         | 25.28         | 26.43         | 24.82         | 26.44         | 25.34         | 23.43         | 23.61         |
| Beef                             | 11.73         | 11.49         | 10.59         | 11.14         | 11.76         | 11.24         | 11.93         | 11.45         | 13.07         | 11.85         | 10.74         | 11.04         |
| Pork                             | 6.46          | 5.90          | 6.05          | 6.28          | 6.83          | 6.34          | 6.62          | 5.58          | 6.77          | 6.15          | 6.00          | 5.74          |
| Other Meats                      | 3.59          | 3.87          | 3.28          | 4.10          | 3.71          | 4.00          | 4.38          | 4.22          | 3.29          | 3.86          | 3.38          | 3.49          |
| Poultry                          | 3.45          | 3.57          | 3.48          | 4.23          | 3.59          | 3.72          | 3.49          | 3.55          | 3.32          | 3.49          | 3.33          | 3.24          |
| Fish                             | 1.71          | 1.88          | 1.64          | 2.31          | 1.58          | 1.81          | 1.69          | 1.71          | 1.60          | 1.87          | 1.83          | 1.79          |
| Fats and Oils                    | 1.36          | 2.05          | 1.51          | 2.18          | 1.46          | 2.24          | 1.52          | 2.36          | 1.33          | 1.99          | 1.11          | 1.82          |
| Beverages                        | 4.27          | 4.16          | 4.87          | 4.90          | 4.38          | 4.65          | 4.48          | 4.34          | 4.21          | 3.93          | 3.90          | 3.77          |
| Miscellaneous Groceries          | 5.57          | 6.22          | 5.59          | 6.95          | 6.12          | 6.74          | 6.15          | 6.66          | 5.40          | 6.34          | 5.02          | 5.37          |
| Fruits and Vegetables            | 12.78         | 11.65         | 14.13         | 13.35         | 12.82         | 13.41         | 12.60         | 11.08         | 13.29         | 11.33         | 11.78         | 10.84         |
| Frozen Food                      | 1.33          | 1.64          | 1.05          | 1.20          | 1.14          | 1.60          | 1.16          | 1.69          | 1.42          | 1.70          | 1.71          | 1.77          |
| Prepared Food                    | 1.91          | 1.78          | 2.10          | 1.91          | 1.93          | 1.87          | 1.90          | 1.86          | 1.87          | 1.82          | 1.95          | 1.65          |
| Food at Home                     | 77.96         | 74.90         | 78.15         | 80.43         | 79.30         | 79.33         | 81.67         | 76.19         | 79.56         | 75.25         | 72.27         | 69.37         |
| Food Away from Home <sup>a</sup> | 22.03         | 25.09         | 21.84         | 19.56         | 20.71         | 20.69         | 18.32         | 23.82         | 20.44         | 24.74         | 27.72         | 30.62         |
| <b>TOTAL FOOD</b>                | <b>100.00</b> | <b>100.00</b> | <b>100.00</b> | <b>100.00</b> | <b>100.00</b> | <b>100.00</b> | <b>100.00</b> | <b>100.00</b> | <b>100.00</b> | <b>100.00</b> | <b>100.00</b> | <b>100.00</b> |

<sup>a</sup>Includes board paid by family members.

Source: Table 1

The income level does not seem to affect expenditures on fats and oils. Expenditures on miscellaneous grocery products and dairy products also appear to be very constant (Figure 6). However, by examining the individual items within these commodity groups, one may find different response patterns to rising income.

In both years as income goes up, weekly per capita expenditure on frozen food shows a slight but very regular upward trend, as opposed to expenditure on fruits and vegetables, which is very unstable (Figure 7).

In 1969 and 1974 with rising income there is no definite trend in expenditure patterns for beverages and eggs while the demand for cereal and bakery products is very irregular (Figure 8).

## **CHANGES IN EXPENDITURE, CONSUMPTION AND PRICES FOR INDIVIDUAL FOODS**

Table 5 gives information on changes in food expenditures, consumption and prices between 1969 and 1974. The commodity groups are broken down into their components to show how patterns for individual foods have changed. The Consumer Price Index for food as a whole increased 48.3 percent during the period while the increase for food at home was 46.6 percent and that for food away from home was 58 percent. As indicated earlier, per capita consumption of food as a whole was virtually the same in 1974 as in 1969. Thus, higher prices appear to explain increases in food expenditures. Consumers in 1974 spent 48.4 percent more for total food, 42.6 more for food at home and 69 percent more for food away from home.

Considering the main items of the family food budget, changes of major interest between 1969 and 1974 are given below.

### **Dairy Products**

Weekly per capita expenditure on dairy products rose from \$1.10 to \$1.41 (28 percent). Cheese contributed to a certain extent to this increase, as opposed to butter, whose expenditure dropped 11 percent.

Per capita consumption of total dairy products declined slightly, mainly because milk (fresh, powdered and evaporated), ice cream and butter consumption was down. Consumption of most cheese was up, especially processed and "other" cheese.

### **Eggs**

Expenditure on eggs, which represents a small share of total expenditure, rose 19 percent (from \$0.21 to \$0.25 per person). Per capita consumption, however, dropped from .35 to .33 dozen (5.1 percent). The price index was up 38 percent.

### **Bakery and Cereal Products**

Per capita expenditure on bakery and cereal products rose 21.2 percent and 76.5 percent respectively, with rising expenditures recorded for bread, crackers, prepared breakfast cereals, flour, cake mixes, macaroni and other cereal products.

Except for the consumption of bread (-16.6 percent), cookies (-28.6 percent) and unprepared breakfast cereal (-13.5 percent), the per capita consumption of other bakery and cereal products has increased slightly.

A 47-percent increase occurred in the price index for cereal and bakery products. In the case of sweet baked goods, sugar price increases were the major cost factor. For bread and other bakery products, costlier inputs were sugar, oil and packaging materials. Higher wages and transportation costs were other contributors to cost increases for both cereal and bakery products.

### **Meat and Poultry**

Weekly per capita expenditure on total meat and poultry rose 46 percent (from \$2.31 to \$3.37). This increase was caused mainly by greater expenditures on stewing beef, hamburger, fresh ham and fresh shoulder cut of pork.

The data indicate that per capita consumption of certain meats seems to be declining, notably some pork cuts (smoked ham, bacon and sausage), veal, lamb, canned meat and chicken. There has been an upswing in consumption of stewing beef, hamburger, fresh loin, fresh ham, fresh shoulder of pork and turkey.

The price index rose 54 percent for beef, 31 percent for pork, 48 percent for other meat and 71 percent for poultry. These increases would mainly be due to higher liveweight prices received by beef producers, and higher feed grain costs of hog and poultry producers.

### **Fish**

In 1974, while fish accounted for only 1.8 percent of the consumer's food dollar, expenditure rose 63 percent (from \$0.16 to \$0.25). Expenditure on canned tuna was up 154 percent.

TABLE 5. CHANGES IN FOOD EXPENDITURE, CONSUMPTION AND PRICES

| Commodity                      | Percent Change, 1974 from 1969 |                        |             | Commodity                            | Percent Change, 1974 from 1969 |                        |             |
|--------------------------------|--------------------------------|------------------------|-------------|--------------------------------------|--------------------------------|------------------------|-------------|
|                                | Per Capita Expenditures        | Per Capita Consumption | Price (CPI) |                                      | Per Capita Expenditures        | Per Capita Consumption | Price (CPI) |
|                                | - % -                          |                        |             |                                      | - % -                          |                        |             |
| Dairy Products                 | 28.18                          |                        | 35.08       | Fats and Oils                        | 115.38                         |                        | 65.74       |
| Fresh Milk                     | 24.50                          | - 28.18                | 36.51       | Margarine                            | 127.27                         | + 35.88                | 75.73       |
| Evaporated Milk                | 17.65                          | - 25.92                | 54.45       | Shortening                           | 88.89                          | - 3.85                 | 67.75       |
| Powdered Milk                  | 5.26                           | - 32.00                | 34.79       | Lard                                 | 133.33                         | - 11.77                |             |
| Ice Cream                      | 10.26                          | - 22.00                | 32.39       | Oil - Corn and Peanut                | 232.00                         | + 111.98               |             |
| Butter                         | -11.41                         | - 27.10                | 21.52       | Salad Dressing                       | 94.74                          | + 20.03                | 43.39       |
| Cheddar Cheese                 | 48.21                          | - 5.80                 | 50.44       | Others                               | 48.00                          | + 14.52                |             |
| Processed Cheese               | 95.12                          | + 37.82                | 36.85       | Beverages                            | 43.59                          |                        | 34.12       |
| Cottage Cheese                 | 68.75                          | + 5.00                 |             | Coffee, regular                      | 32.00                          | - 5.17                 | 40.21       |
| Other Cheese                   | 173.21                         | + 82.30                |             | Coffee, instant                      | 52.38                          | + 16.18                | 26.70       |
| Other Dairy Products           | 21.21                          | + 18.66                |             | Tea                                  | 27.66                          | + 17.28                | 11.95       |
| Eggs                           | 19.05                          | - 5.13                 | 37.60       | Soft Drinks                          | 47.64                          | + 8.61                 | 42.56       |
| Bakery Products                | 20.29                          |                        |             | Others                               | 46.34                          | + 26.81                |             |
| Bread                          | 26.86                          | - 16.62                | 52.22       | Miscellaneous Groceries              | 64.71                          |                        | 70.52       |
| Cookies, biscuits, wafers      | 8.96                           | - 28.58                |             | Sugar                                | 286.00                         | + 1.30                 | 281.12      |
| Crackers                       | 113.64                         | + 32.25                | 38.13       | Honey, Syrup, Molasses               | 72.00                          | - 4.57                 |             |
| Others                         | 12.16                          |                        |             | Others                               | 40.09                          | + 5.07                 |             |
| Cereal Products                | 76.47                          |                        |             | Fruits, Processed                    | 22.22                          |                        | 34.67       |
| Breakfast Cereal, prepared     | 52.54                          | + 21.99                | 35.43       | Canned Peaches                       | 5.26                           | - 27.46                | 29.54       |
| Breakfast Cereal, to be cooked | 0                              | - 13.53                |             | Canned Pears                         | 11.11                          | - 26.21                | 23.05       |
| Flour                          | 51.61                          | + 9.16                 | 42.33       | Canned apple juice                   | 42.11                          | - 8.49                 | 49.73       |
| Cake Mixes                     | 57.90                          | + 21.56                | 33.01       | Canned orange juice                  | 20.00                          | - 6.44                 | 7.36        |
| Macaroni                       | 113.64                         | + 37.11                |             | Raisins                              | 44.44                          | - 20.64                | 76.03       |
| Others                         | 245.46                         | + 54.61                |             | Others                               | 23.40                          | - 2.89                 |             |
| Beef                           | 45.79                          |                        | 53.59       | Vegetables, Processed                | 10.53                          |                        | 35.89       |
| Loin, Round and Rib Cuts       | 49.08                          | + 41                   |             | Canned Peas                          | -12.90                         | - 38.48                | 27.51       |
| Stewing Beef                   | 196.43                         | + 105.71               | 52.00       | Canned Corn                          | -3.57                          | - 30.01                | 25.75       |
| Hamburger                      | 84.23                          | + 23.86                | 62.31       | Canned Baked Beans                   | 4.55                           | - 34.10                | 57.74       |
| Others                         | 7.91                           | - 44.25                |             | Canned Tomatoes                      | 4.55                           | - 19.44                | 29.10       |
| Pork                           | 35.59                          |                        | 30.96       | Canned Tomato Juice                  | 4.55                           | - 20.63                | 29.44       |
| Bacon                          | 11.50                          | - 15.45                | 35.57       | Others                               | 36.51                          | - .34                  |             |
| Smoked Ham                     | 9.16                           | - 25.00                | 22.20       | Fruit, Fresh                         | 30.95                          |                        | 69.15       |
| Smoked, Cottage, Roll          | 42.11                          | 0                      | 38.17       | Oranges                              | 19.05                          | - 21.37                | 27.28       |
| Loin, fresh                    | 45.75                          | + 12.90                | 32.26       | Bananas                              | 12.50                          | - 2.67                 | 7.16        |
| Ham, fresh                     | 207.69                         | + 178.57               |             | Apples                               | 48.94                          | - 9.06                 | 56.13       |
| Shoulder, fresh                | 123.53                         | + 59.18                | 21.67       | Grapefruit                           | 6.45                           | - 28.48                | 33.67       |
| Sausage                        | 26.00                          | - 17.11                | 42.68       | Grapes                               | -11.32                         | - 40.63                |             |
| Others                         | 32.05                          | - 7.41                 |             | Others                               | 71.13                          |                        |             |
| Other Meat                     | 57.57                          |                        | 48.24       | Vegetables, Fresh                    | 56.41                          |                        | 47.41       |
| Veal                           | 4.76                           | - 35.00                | 62.09       | Potatoes                             | 85.19                          | - 20.15                | 101.77      |
| Lamb                           | 6.45                           | - 39.02                |             | Tomatoes                             | 38.89                          | + .48                  | 47.87       |
| Weiners                        | 40.43                          | - 1.32                 | 40.04       | Lettuce                              | 34.04                          | + 14.11                | 19.43       |
| Canned Meats                   | 8.00                           | - 40.00                | 47.39       | Carrots                              | 17.86                          | - 9.69                 | 30.61       |
| Others                         | 103.68                         | + 21.15                |             | Celery                               | 7.14                           | - 14.41                | 13.42       |
| Poultry                        | 53.13                          |                        | 70.76       | Onions                               | 36.36                          | + 4.29                 | 39.36       |
| Chicken                        | 50.00                          | - 6.55                 | 72.03       | Cabbage                              | 25.00                          | - 20.49                | 30.85       |
| Turkey                         | 66.67                          | + 8.67                 | 57.83       | Turnips                              | 11.11                          | - 26.32                | 17.90       |
| Others                         | 43.75                          | - 5.71                 |             | Cucumbers                            | 43.75                          | + 5.98                 |             |
| Total Meat and Poultry         | 45.89                          |                        |             | Others                               | 92.31                          |                        |             |
| Fish                           | 62.50                          |                        | 102.89      | Frozen Foods                         | 83.33                          |                        |             |
| Cod, Halibut and Salmon        |                                |                        |             | Frozen orange juice                  | 81.82                          | + 69.11                | -74         |
| (Fresh, Frozen or Smoked)      | 81.82                          | - 12.12                |             | Frozen peas                          | 11.11                          | - 25.22                | 28.65       |
| Canned Salmon                  | 29.03                          | - 26.92                | 85.57       | Frozen potatoes                      | 122.22                         | + 59.00                |             |
| Canned Tuna                    | 153.85                         | + 58.45                |             | Frozen corn                          | 0                              | + 11.05                |             |
| Others                         | 57.14                          | + 12.65                |             | Frozen fish                          | 53.85                          | + .36                  |             |
|                                |                                |                        |             | Meat and Poultry Dinners             | 94.74                          | + 68.73                |             |
|                                |                                |                        |             | Prepared and Partially Prepared Food | 33.33                          |                        |             |
|                                |                                |                        |             | Food at Home                         | 42.56                          |                        | 46.58       |
|                                |                                |                        |             | Food Away From Home                  | 69.15                          |                        | 57.89       |
|                                |                                |                        |             | Total Food                           | 48.41                          |                        | 48.29       |

Sources: Statistics Canada, *Family Food Expenditure Survey, 1969*.  
Selected Data, Ottawa, January 1976.  
Statistics Canada, *Urban Family Food Expenditure Survey, 1974*.  
Selected Data, Ottawa, January 1976.  
Consumer Price Index (1971 = 100) for 1969 and 1974.  
Statistics Canada, *Price and Price Indices*, Cat. 62-002, 1969 and 1974.

Fish consumption remained relatively constant. Higher consumption of canned tuna and other fish offset the decreasing amounts of cod, halibut and salmon consumed.

The price index for fish, which includes canned tuna as well as varieties of fresh and frozen fish, rose 103 percent. Much of this increase was due to an increase in the retail price of canned salmon.

### Fats and Oils

Fats and oils is the commodity group that registered the sharpest increase in expenditure (115 percent). Corn and peanut oil (232 percent), margarine (127 percent) and lard (133 percent) accounted for most of this increase.

There was higher consumption of margarine, salad dressing and, most noticeably, corn and peanut oil. On the other hand, consumption of shortening and lard is decreasing.

The price index for fats and oils rose 66 percent. Prices are largely determined by the international price of vegetable oil, which, along with animal fat, is the major raw material used in the fats and oils industry. Soybean oil prices increased almost 130 percent between May 1973 and the end of 1974<sup>14</sup>. Prices of rapeseed, linseed, peanut, coconut and palm oil followed a similar pattern.

### Beverages

Per capita expenditure on beverages rose 44 percent (from \$0.39 to \$0.56).

Increasing per capita consumption is observable among beverage products except regular coffee (does not include instant coffee).

In 1974 the price index for beverages was 34 percent higher than in 1969. Higher coffee prices were due to rising world prices. Sugar accounted for the higher prices of soft drinks.

### Miscellaneous Groceries

Per capita expenditure on miscellaneous groceries, which includes soups, baby food, chocolate, sugar, jelly powder, honey, jam, peanut butter, pickles, catsup and others, rose 65 percent (from \$0.51 to \$0.84). Sugar

expenditures led with a rise of 286 percent (from \$0.05 to \$0.19).

Per capita consumption of sugar rose 1.3 percent in contrast to consumption of molasses, honey and syrups, which dropped almost 5 percent.

The price index for miscellaneous groceries rose 71 percent. The index for sugar rose 281 percent, with prices strongly influenced by international factors such as poor harvest and increasing consumption.

### Fruits and Vegetables

Per capita expenditure on fruits and vegetables increased 35 percent (from \$1.18 to \$1.59), with fresh vegetables, processed fruits and most fresh fruits leading the way.

Per capita consumption of most fruits and vegetables is declining although tomatoes, lettuce, onions and cucumbers are on an upward trend.<sup>15</sup>

The price index for fruits and vegetables has been rising. Prices for raisins, canned baked beans, apples and particularly fresh potatoes, show major increases. This upward trend is partly due to greater transportation and processing costs. The processing industry is particularly susceptible to outside cost pressures (sugar cost). Growers and processors have also been facing rising costs for labor and machinery.

### Frozen Food

Per capita expenditure on frozen food was up 83 percent (from \$0.12 to \$0.22). The major contributors were potatoes, orange juice, and meat and poultry dinners.

Peas are the only item whose consumption is declining. Consumption of all others is rising, especially that of orange juice, potatoes, meat and poultry dinners.

The price index was down .7 percent for orange juice and up 29 percent for peas. Packaging materials are the major causes of rising prices.

### SUMMARY

In 1974, consumers spent 48 percent more on total food than in 1969. They spent 69 percent more on food away from home and 43 percent more on food at home.

<sup>14</sup> See Final Report of the Food Prices Review Board, 1976, page 13.

<sup>15</sup> Seasonal consumption of fresh fruits and vegetables has to be considered in drawing conclusions from the data presented in Table 5.

From 1969 to 1974, changes in per capita food expenditures are noticeable among all five income groups (quintiles). In all groups, the increase in expenditures on cereals, poultry, fish, fats and oils, fresh vegetables, miscellaneous groceries, and frozen food is generally sharper than that on milk, bakery products, canned and dried fruits and vegetables.

Consumers in 1974 spent more of their total food dollar on food away from home than in 1969, with the share rising from 22 to 25 percent. In 1974, meat and poultry, fruits and vegetables, dairy products, and cereal and bakery products represented a smaller share of the consumer's food budget than in 1969, as opposed to fish, fats and oils, miscellaneous groceries and frozen food, whose shares were larger.

In both years, the main items of the family diet are, in order of importance: meat and poultry, fruits and vegetables, dairy products, cereal and bakery products, miscellaneous groceries, beverages, eggs, fish, fats and oils, prepared dishes and frozen food.

In 1969 and 1974 higher income increased the demand

for food away from home, total food, red meat, high- and medium-quality cuts of beef and frozen food. As income rises expenditures on food at home, fish, poultry, low-quality cuts of beef, eggs, dairy products, and fats and oils appear fairly constant. Irregular trends are observed for fruits, vegetables, cereals and bakery products.

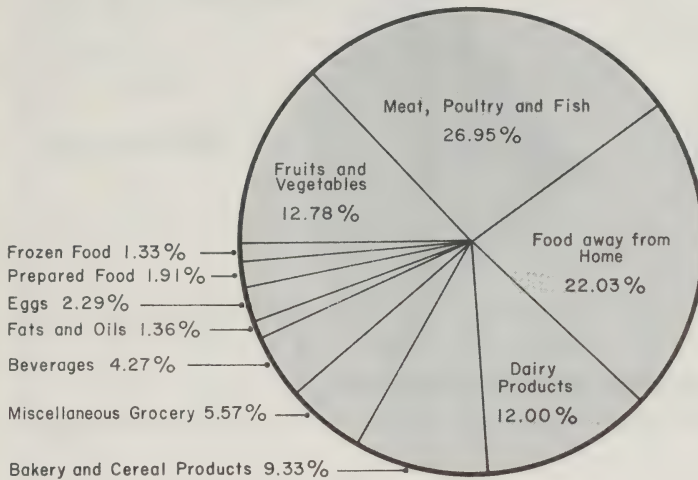
There was a general increase in per capita expenditures among individual commodities with the exception of butter, some cuts of beef, canned peas, canned corn and grapes.

Per capita consumption of cheese, most cereal products, beef, fats and oils, beverages and frozen food has risen. Consumption of other dairy products, eggs, most bakery products, pork, other meat (veal, lamb, canned meat and chicken), fruits (fresh and processed) and processed vegetables has decreased.

Except for frozen orange juice, there was an increase in the price index for all food items, particularly evaporated milk, beef, veal, poultry, canned salmon, most of the fats and oils, sugar, raisins, apples and potatoes.

# ALL FOOD EXPENDITURES

1969



1974

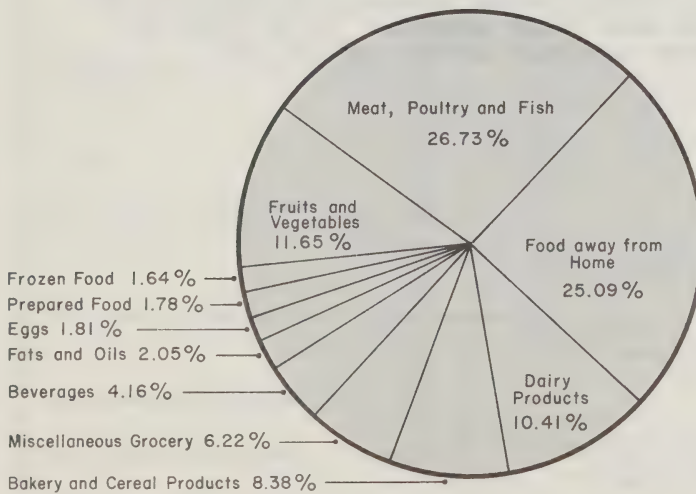


Figure 1

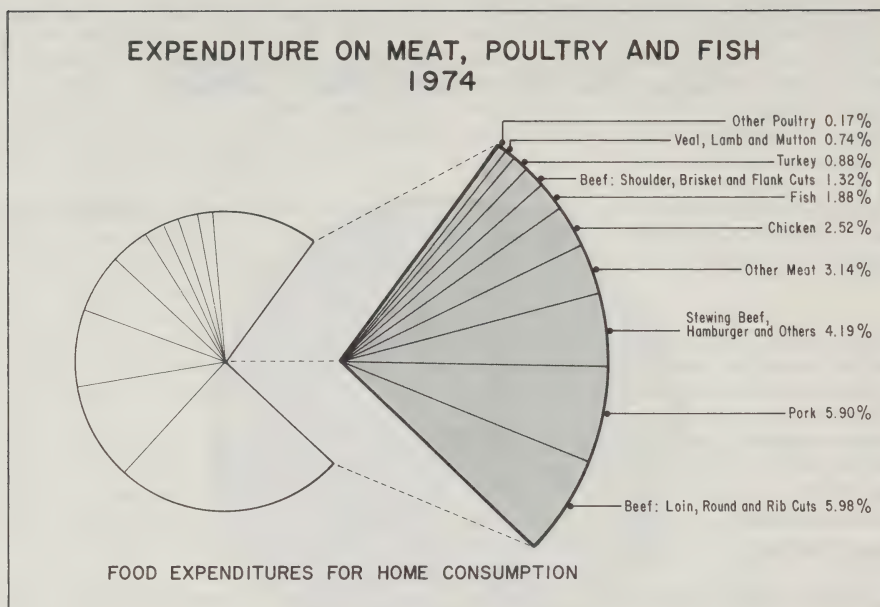


Figure 2

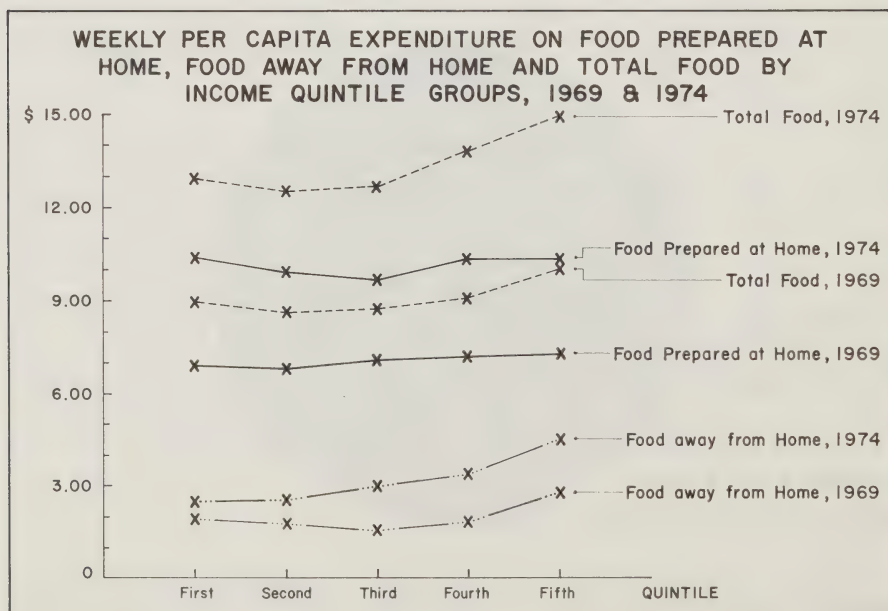


Figure 3

# WEEKLY PER CAPITA EXPENDITURE ON RED MEAT, POULTRY AND FISH BY INCOME QUINTILE GROUPS, 1969 & 1974

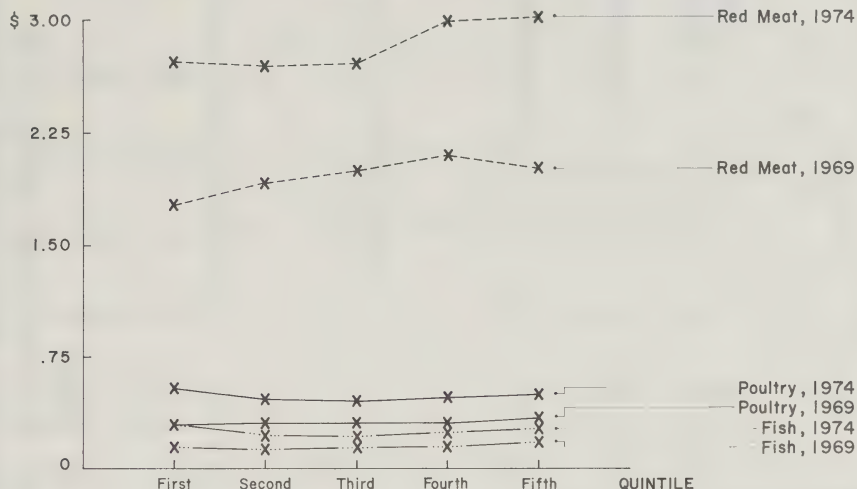


Figure 4

# WEEKLY PER CAPITA EXPENDITURE ON VARIOUS CUTS OF BEEF BY INCOME QUINTILE GROUPS, 1969 & 1974

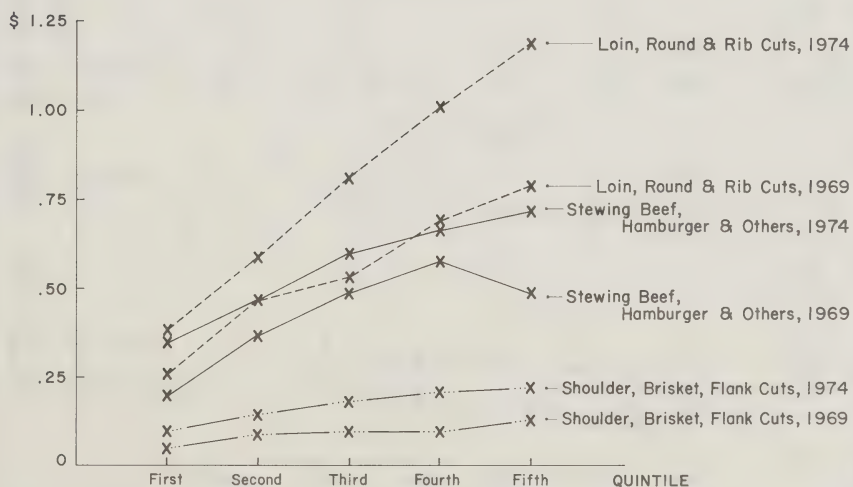


Figure 5

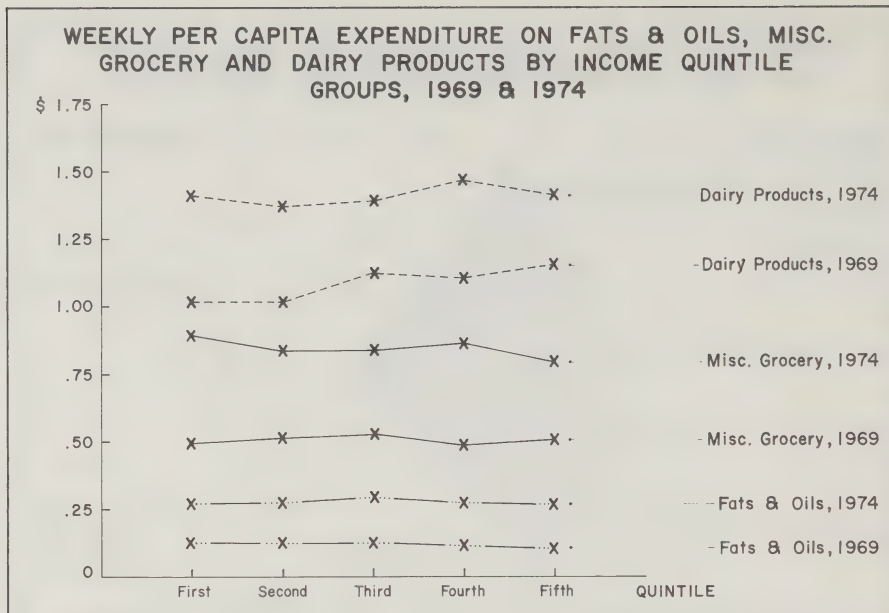


Figure 6

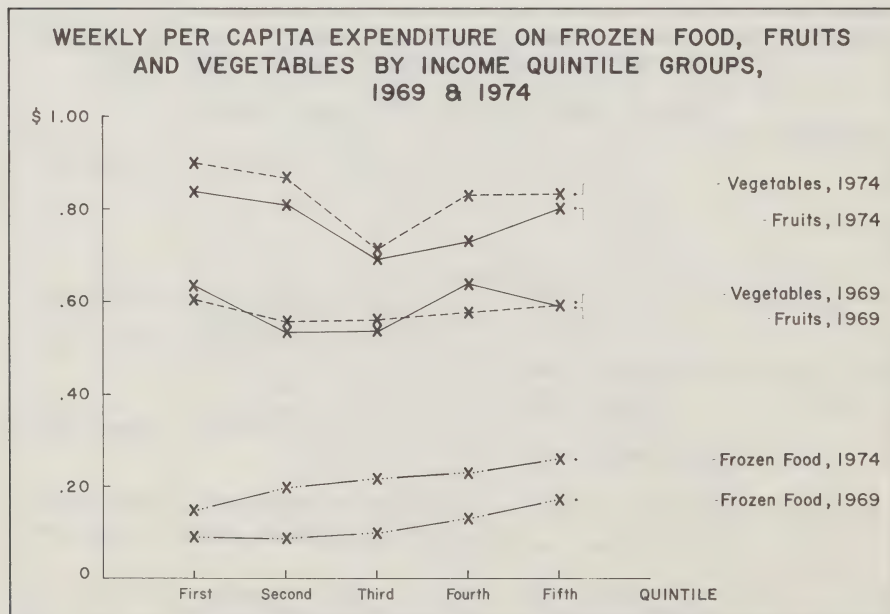


Figure 7

# WEEKLY PER CAPITA EXPENDITURE ON BEVERAGES, EGGS, CEREAL AND BAKERY PRODUCTS BY INCOME QUINTILE GROUPS, 1969 & 1974

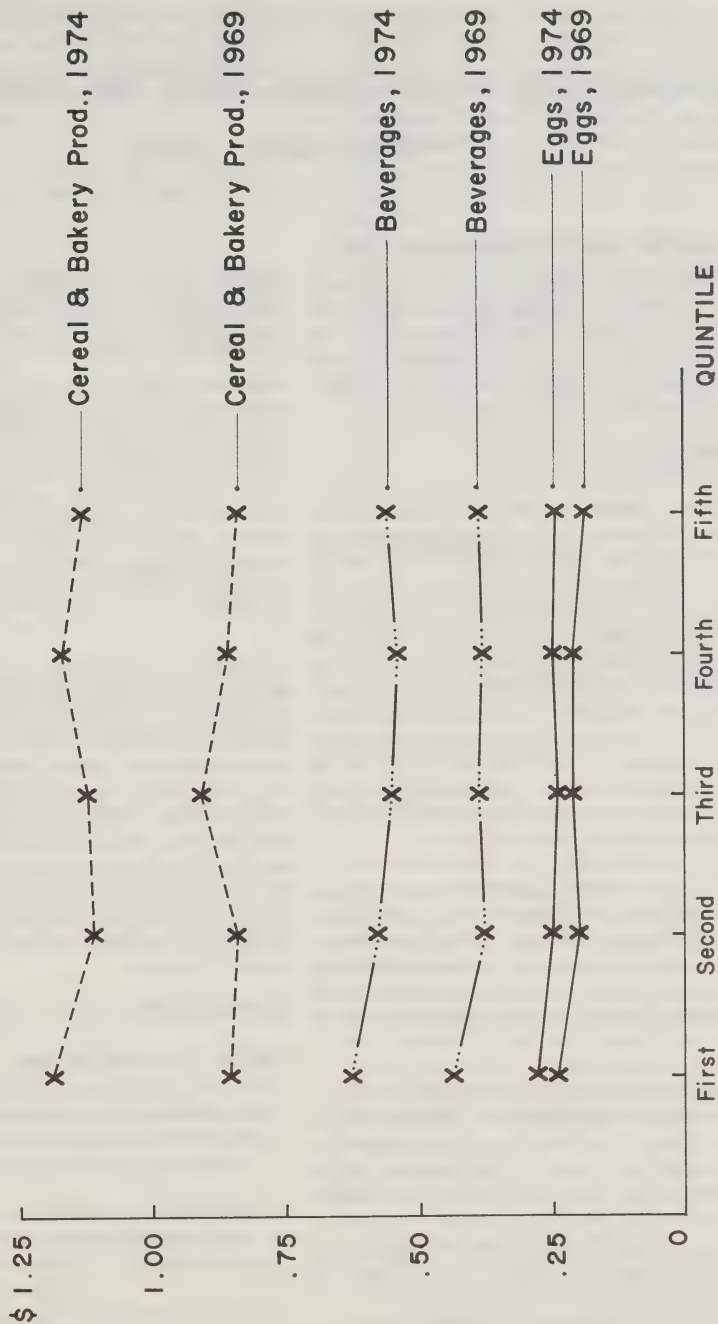


Figure 8

# COMMISSION OF INQUIRY INTO THE MARKETING OF BEEF AND VEAL

## CONCLUSIONS AND RECOMMENDATIONS

*This note reports the conclusions and recommendations\* of the federal inquiry into the marketing of beef and veal. The commission listed recommendations for veal marketing separate from beef because, although similarities existed, the system for veal was thought to be sufficiently different to justify individual attention.*

## BACKGROUND

A commission of inquiry into beef and veal marketing in Canada was established by the federal government on January 6, 1975. This followed months of discussion in 1973 and 1974 when the entire marketing system for beef came under study by both producers and consumers. The commission's mandate was to examine the organization, methods of operation and price-setting mechanisms of the marketing system for beef and veal, to report on the overall effectiveness of the system and to submit to the government any recommendations that might help improve it. The commission interpreted its terms of reference to cover the marketing system from the first change of ownership of the live animal to the final sale of the product at the retail counter.

The Canadian beef industry entered an expansion phase in the late sixties. Low grain prices, rising cattle prices and growing consumer demand for beef spurred the expansion. Heifers were withheld for breeding, lowering the beef supply in the early seventies. Cattle prices reached record levels in the late summer and fall of 1973.

The high calf and grain prices later combined to put the feedlot industry in a profit squeeze. This resulted in a slackening demand for feeder calves, which were in plentiful supply as a result of the expansion in the breeding herd. Calf prices then plummeted, causing

financial hardship for cow-calf operators, who began culling their breeding herds. Meanwhile, similar developments were occurring on the international scene.

Consumers thought there was an unduly large difference between the price they were paying for beef at the retail counter and the price beef producers were receiving for their cattle and calves.

Compounding the problems in Canada were high inflation levels and various degrees of economic recession throughout the world, resulting in reduced demand for beef and protective action by various countries.

Recognizing the concerns of producers, marketing agencies and consumers, the government appointed three commissioners — Lydia Patry-Cullen, Hu Harries and Maxwell W. Henderson (Chairman) — to head a study of the beef marketing system. Public hearings were held across the country and marketing was studied at the producer, packer, wholesale and retail level. The conclusions below are those the commission considered most important in its study of an industry that in recent years has accounted for over one fifth of Canadian farm cash receipts. The popularity of beef is reflected in the fact that in 1975 per capita consumption in Canada was a record 102 pounds.

## CONCLUSIONS

### The Beef Marketing System

1. Consumers do not receive adequate or even accurate information of the grade and cut of the beef they purchase at the retail counter.
2. The market information reporting system is insufficient, inaccurate, fragmented, and unresponsive to change.
3. The marketing system has, because of a number of constraints, been unprogressive in some important areas.

\*The conclusions and recommendations are reproduced here exactly as they appear in the report. They are solely the opinions of the commission and in no way represent the views of Agriculture Canada or the Government of Canada.

Copies of the report are available from Printing and Publishing, Supply and Services Canada, Ottawa, K1A 0S9. Price: Canada \$5.50; other countries \$6.50.

4. The marketing system has been reasonably effective in ensuring adequate supplies of beef for Canada's growing population and the Commission is satisfied producers in Canada have responded to the growth in consumer demand.
5. The assurance of a wholesome supply of beef to the retail counter has not been as effective as it might be.
6. There are serious inequities in the prices producers receive for live cattle of the same quality in the same market. These inequities occur regardless of how the producer sells his animals or the region in which they are sold.
7. There are important inequities in the live and carcass beef prices paid, respectively, to producers and packers in different regions of the country. Some of these inequities are more pronounced for lower grade animals and for heifers.
8. The marketing system has generated unjustified price discrimination against some classifications of beef produced in Canada.
9. The lack of uniformity in names of beef cuts and the absence of grade identification at the retail counter make accurate price comparisons difficult if not impossible.
10. Consumers in Western Canada suffer from serious retail price inequities.<sup>1</sup>
11. If carcass beef processing continues to be done by retailers, this will inhibit the more important gains that can be made in the marketing system for the future.
12. There are unnecessary costs in the marketing system.
13. The live to wholesale price spreads vary significantly by grade and show substantial regional differences. Wholesale to retail price spreads vary greatly within markets and by region.
14. While, on average, a reasonably constant share of the consumer's dollar goes back to the producer, it is significantly less than the 75% that has been reported by some agencies.
15. Producers do not seem to have chosen the most economical method of marketing their animals for slaughter.
16. The receipt of part of the saving in the form of a freight rebate by the wholesaler in Montreal is in fact a hidden increase in his commission which distorts the reported carcass market price in Montreal.
17. Freight rates are not a significant deterrent to the location of packinghouse activity in Western Canada. The *Feed Freight Assistance Act* is not a factor in the interregional aspects of beef production. The fuller utilization of existing facilities and the opportunity to develop a stable beef finishing and processing industry in the West is placed in jeopardy by the dramatic spread that now exists between the Crow's Nest Pass rates and all other transport costs.

### **The Veal Marketing System**

18. The live calf marketing system is not performing as effectively as desired. The conclusions with respect to health standards, market information, costs and price spreads in the beef marketing system also apply to the veal marketing system.

## **RECOMMENDATIONS**

### **The Beef Marketing System**

1. The Commission rejects the principle of regulated domestic production for beef and veal. The real equity and income problems faced by beef producers should not be solved by controls on production.
2. The output of all packinghouses in Canada should be processed at least to the sub-primal stage and boxed at the point of slaughter and early action should be taken by government to reverse the current trend to growth in central processing by retailers.
3. Retailers should be required to clearly label the grade of beef on the packaged beef cuts sold at their retail counter and clearly state that grade of beef in any form of advertising they use.
4. There should be an integrated set of national meat inspection standards developed jointly by the Federal and Provincial governments.

<sup>1</sup> See memorandum of Commissioner Harries, Chapter 14.3.1 and memorandum of Commissioner Patry-Cullen, Chapter 14.2.2

5. The identification of carcasses for railgrade payment to producers should be subject to government supervision, all weighing of railgraded carcasses should be carried out by independent bonded weigh masters not in the employ of the packer, and differentials in conformity with physical and market criteria should be determined for the purpose of final payment to producers.
6. Arrangements should be made so that all packers purchase all animals for slaughter exceeding some established minimum weight, perhaps 700 lbs. live-weight, for immediate payment on an official railgrade and weight basis.<sup>2</sup>
7. Teletype auctions for the purchase of all slaughter animals exceeding an established minimum weight, perhaps 700 lbs. liveweight, for payment on an official railgrade and weight basis should be introduced at least in Alberta, Saskatchewan, Manitoba and Ontario.<sup>3</sup>
8. The terminal stockyards (except the one in Regina) should be closed. Better located public assembly points for live animals should be established. All auctions in Canada for the sale of animals on a liveweight basis should be classified into two groups:
  1. those with 20,000 or more cattle, calf or cow marketings per annum which would be designated public markets subject to a revised set of national regulations under the *Livestock and Livestock Products Act*; and,
  2. those with less than 20,000 cattle, calf or cow marketings per annum which would continue to be subject to Provincial jurisdiction.
9. The Federal Government should develop a comprehensive, consistent market information collection system employing modern techniques for the distribution of this information to the widest group of participants and users possible. The Federal Government should leave the field of market forecasts to private agencies but be prepared to help finance those interest groups who prepare such market analysis for general information.
10. All freight rebates paid by packers to wholesalers in Montreal should cease.
11. The principle of statutory tariff quotas is rejected by the Commission. The existing *Export and Import Permits Act* provides all the latitude and authority necessary to safeguard the Canadian market from undue supply and demand forces or from sudden policy changes in other countries.
12. The Canadian government should press for reciprocity with the U.S.A. in the tariff levels applied to all live cattle, calves, fresh and frozen beef and veal.
13. A common code or set of health standards for cattle and beef should be developed among Canada's main trading partners, particularly with the U.S.A.
14. The deferral of capital gains tax, as it now applies to the family farm, should be extended to cover family farming corporations.
15. A taxpayer's income from a farming business should be included in the list of items which would qualify an amount as a deductible payment for an income averaging annuity.

### The Veal Marketing System

16. While there should be improvements in the regulation of the numerous small auction markets in Canada, there should be no direct move to concentrate them into fewer bigger units.
17. The marketing of veal calves should be made more effective by improving the existing mechanisms of terminal and country auctions and by improving the scope and integration of health inspection standards, as described in Chapter 11.
18. Retailers should make a greater contribution to consumers' wants and to the veal producers' market by extending their efforts to create a better demand for veal. Recent experience with such promotions in Western Canada should be followed.
19. The veal producer should be encouraged to increase the output of milk-fed veal by making milk powder available at the same price it would obtain in the export market.

<sup>2</sup> Commissioner Harries dissents from this recommendation. See Chapter 14.3.3.

<sup>3</sup> Ibid.

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# FARM CREDIT CORPORATION:

## ANNUAL REPORT

The 1975-76 annual report of the Farm Credit Corporation points out that Canadian farmers borrowed 60 percent more credit (\$641 million compared with \$399 million the year before) during this fiscal year than any previous year. Major factors contributing to this record volume of approved loans were the 1975 amendments to the Farm Credit Act and favorable economic farm conditions. During this period, 9,945 loans were approved, 23 percent more than in the year before, while the average size of loans increased to \$64,450 from \$49,279.

Nearly 67 percent of the loans went to farmers who were in the under 35 age group, compared with just over one half in 1974-75. Borrowers under 25 years of age increased to 23.6 percent from 18 percent the previous year.

In order of importance, farmers in Ontario borrowed \$189.4 million (2,677 loans), in Saskatchewan \$143.6 million (2,385 loans), in Quebec \$120 million (1,881 loans), in Alberta \$112 million (1,684 loans), and in Manitoba \$43.4 million (810 loans). Their repayment record was good; 90.8 percent of the \$44.6 million that was due was repaid. Interest rates on loans during the year were 8.5 and 9 percent.

The report states, "during the last few years, we have seen unprecedented levels of capital requirements and farm financing. Although the demand for funds varies from year to year, there is little doubt that further technological and management advances, together with rising land prices, will result in a continuing increase in the demand for long-term credit".

The Corporation offers both pre-loan and post-loan advisory services. As of March 31, 1976 post-loan advisory services were being provided to 4,472 borrowers of which 1,620 were using CANFARM's system of farm record-keeping. The majority of the Corporation's field staff were trained in CANFARM's Version III system. CANFARM business data were also used in counselling FCC clients.

During this period FCC also approved \$4.5 million (231 loans averaging \$19,664) under the Farm Syndicates Credit Act. In addition, it approved \$4.5 million in Small Farm Development vendor assistance grants to 1,475 farmers who were retiring or making adjustments and \$1.7 million was approved under the special credit provisions of the plan to help 104 farmers expand their operations. These grants were funded by Agriculture Canada.

*J.J.M.*

# LEGISLATION

## LIVESTOCK FEED ASSISTANCE ACT

### Feed Grain Transportation and Storage Assistance

#### Amendment to Regulations, effective August 1, 1976

The Regulations as amended set a new rate of payment of 5 cents a bushel for storing feed grains — an increase of  $2\frac{1}{2}$  cents. The revised Schedule I of the Regulations sets the rates of payment for shipping feed grain to Eastern Canada. Schedule II as amended does the same for British Columbia. The text of the new schedules is printed in the Canada Gazette, Part II, for August 11, 1976.

## AMENDMENT TO CANADIAN WHEAT BOARD ACT

The Act to Amend the Canadian Wheat Board Act (No. 2), formerly Bill C-88, was proclaimed in force on July 27. The Act provides a permanent basis for electing prairie grain producers to the advisory committee of the Canadian Wheat Board, and establishes a separate pool for malting barley and other selected grains that come within the Board's pooling operation.

## ANIMAL CONTAGIOUS DISEASES ACT

### Interim changes, July-August, 1976

Bill C-28, an Act to amend the above Act, received Royal Assent in Parliament on December 20, 1975. It awaits proclamation, following completion of all the supporting regulations, when it will become known as the Animal Disease and Protection Act. The primary purpose of this Act is to provide authority to establish regulations concerning transportation of animals and reduction of sickness and disease. It also provides a new basis for compensation for animals, products and other associated materials and things ordered destroyed under the Act; and it clarifies the authority for other activities carried out under the Act. Royal Proclamation is expected this fall.

In the interim, to deal with urgent conditions arising in the Brucellosis Eradication Program, the existing Act was up-dated by two Orders-in-Council dated July 13 and August 5. The first (Canada Gazette, July 28) provides for new regulations for the registration of livestock dealers; the second (Canada Gazette, August 25) provides for an increase from \$450 to \$600 in the maximum compensation paid for purebred cattle ordered slaughtered under disease-eradication programs for animals infected with brucellosis, tuberculosis or Johne's disease.

# PROGRAMS AND POLICIES

## Changes in Provincial Milk Quotas

The Government modified the dairy policy it had announced in April, following a meeting in July with provincial ministers of agriculture. On August 5 Agriculture Minister Whelan announced that the provinces then imposing monthly quotas on manufacturing milk would be allowed to suspend or modify those allocations, provided that the cumulative monthly production in a province was maintained within the limit established by the Canadian Dairy Commission. Provincial agencies were to be responsible for keeping production within those guidelines. Each province would be free, subject to the cumulative limit, to set its own levels for production and shipment. This flexible approach to supply man-

agement was designed to achieve the pattern of production most suited to the needs of each province.

## CEMA Given More Control over Production

A new national plan to continue the work of the Canadian Egg Marketing Agency was signed by federal and provincial ministers of agriculture at their meeting in Quebec City at the end of July. The plan gives the national agency more centralized control over egg production. This involves uniform pricing, control of quotas, and penalties for over-production. The agreement is intended to enable provincial producer boards to continue the existing stability in the egg industry for both producers and consumers.

## **CEMA Pricing Formula Sustained**

On August 16 the National Farm Products Marketing Council in Ottawa announced its finding that the pricing formula applied to egg producers by the Canadian Egg Marketing Agency should not be changed. The Council had reviewed the formula at the request of the Consumers' Association of Canada. Its decision was based partly on evidence in 32 briefs submitted during public hearings and partly on data from other sources.

## **Wheat Quotas for Crop Year**

At the end of July the Canadian Wheat Board announced quotas for the crop year 1976-77: 3 bushels on red spring wheat and barley and 5 bushels on oats delivered to the Board. The Board also announced quotas of 10 bushels an acre on rye and 5 on flaxseed and rapeseed delivered to country elevators. Quotas on rye delivered to distillers and on flaxseed and rapeseed delivered to crushers were set at 20, 15 and 15 bushels an acre. There was an open quota on non-Board deliveries of feed, wheat, oats and barley for non-human domestic use. Country elevator stocks of domestic non-Board feed grains are limited to 10 percent of each company's total licensed capacity and to 20 percent of each company's capacity at each delivery point. The 20-percent limitation was made by the Canadian Grain Commission to ensure that domestic feed grains are not allowed to congest the country elevator system in Western Canada.

## **New Pricing Policy for Domestic Feed Grains**

Modifications to the federal government's feed grains policy, announced May 31, came into effect with the start of the new crop year on August 1. The Canadian Wheat Board is offering feed grains at Thunder Bay and country elevators in Western Canada at prices competitive with U.S. corn. The technical basis for the pricing of feed grains, announced on July 14 by the Wheat Board and the Canadian Livestock Feed Board, takes into account the feeding value of wheat, oats and barley in relation to U.S. corn, which is the domestic livestock industry's major alternative to Canadian feed grains and the most important barometer of international feed grain markets. Canadian prices are now tied to the cost of U.S. corn imported into Eastern Canada, to ensure that feed grains remain competitive with U.S. corn across the country.

## **New Crop Development Fund**

Two new projects, one in Ontario, the other in Nova Scotia, were selected to receive funds through Agricul-

ture Canada's New Crop Development Fund. The Kemptville College of Agricultural Technology was allotted nearly \$8,000 for a three-year study of mustard seed production in Eastern Ontario. The crop will be used to support local industry. The Minas Seed Co-operative in Nova Scotia will receive over \$10,000 for a one-year project to help local farmers become large-scale producers of grain. The project, covering the 1976-77 crop year, will concentrate on technical help for production of maximum crops during changeable weather and under varied soil conditions. In each case the Fund pays half the total cost and the recipient pays the rest.

## **Area of British Columbia under Quarantine for Bluetongue**

The quarantine on the part of British Columbia affected by bluetongue disease in cattle, sheep and goats became effective June 30. Cattlemen in the area were ordered, under the terms of the Animal Contagious Diseases Act, to remove animals from their herds that reacted to the bluetongue test. Strict regulations were imposed on movement of animals in and out of the quarantine area. Exports of livestock from the area to the United States were prohibited.

## **New Meat Agreement with Australia and New Zealand**

On July 7 Agriculture Minister Whelan announced that at the request of the Canadian government the governments of Australia and New Zealand had agreed to suspend shipments of beef and veal against contracts concluded before June 11 (Australia) and June 18 (New Zealand). The suspended contracts would become eligible for shipment on re-negotiation in accordance with the new agreement, which fixed the price of beef entering Canada at not more than 6 cents a pound below the same beef entering the United States. In making the agreement the government was concerned that beef imports coming into Canada at prices below those of the United States would undermine the stability of the Canadian market.

## **Sheep Support Program**

The support price for lamb under the Agricultural Stabilization Act from January 1, 1976 to December 31, 1976, was calculated at \$46.15 per hundredweight. The support price is based on 90 percent of average market prices for the previous five years, adjusted to reflect cost changes in cash production in 1976 over the previous five years. The support level for lambs last year was \$47.70 per hundredweight.

## Carrot Stabilization Program

A program to stabilize producers' returns from the 1975 carrot crop was announced on July 21, under the Agricultural Stabilization Act. Producers were unable to obtain adequate prices in that year owing to over-average yields in the United States. Growers were entitled to receive \$2.25 a ton on all carrots marketed in 1975.

## 1975 Apple Crop Support

On August 9, the regulations of the Agricultural Stabilization Act were used to designate the 1975 apple crop for assistance. Among the reasons for this were higher production costs and pressure from imported apples.

Growers were eligible to receive 2.1 cents a pound for fresh and peeler sales, and 0.9 cents a pound for apples sold for juice and other products. It was estimated that some 7,000 growers across the country would receive support payments on about 830 pounds of apples.

## Raspberries Supported in B.C.

An Order-in-Council dated August 5 empowered the Agricultural Stabilization Board to pay 8.6 cents a pound to producers to stabilize the price of raspberries grown in British Columbia in the 1975 crop year and marketed on or before August 31, 1976. The support price was decided on a regional rather than a national basis, and the regulation applied to fruit grown in British Columbia only.

# PUBLICATIONS

## ECONOMICS BRANCH, AGRICULTURE CANADA

*Available from the Publications Manager, Room 303, Sir John Carling Building, Ottawa, K1A 0C5.*

**Policies and Programs for Agriculture: Western Provinces.** First of series of up-dated information from Canadex. Lists type of provincial assistance given, who qualifies, provincial contacts, etc., in Manitoba, Saskatchewan, Alberta and British Columbia. This will be followed by policies and programs for the Atlantic Provinces, Quebec, Ontario and Federal. Western Provinces: Pub. No. 76/12.

**Selected Agricultural Statistics for Canada.** Annual handbook covering crop acreages, livestock numbers, farm cash receipts, expenses, net income, food consumption, trade, etc. Bilingual. Pub. No. 76/10.

## AGRICULTURE CANADA

*Available from the Information Division, Agriculture Canada, Ottawa, K1A 0C7. There is no charge unless otherwise stated.*

**Agriculture Abroad.** Bi-monthly digest of policies and programs. August.

**Farming in Canada.** 1976. General review of the farming industry. Good for prospective farmers. Cat. No. A15-1296.

**Livestock Market Review, 1975.** Bilingual. Cat. No. A71-9/1975.

**Sheep Production and Marketing.** 1976. Cat. No. A63-1582/1976.

## SUPPLY AND SERVICES

*Order from Supply and Services Canada, Printing and Publishing, Publications Centre, Mail Order Services, Ottawa, K1A 0S9.*

**Foreign Competitive Policy and Practice.** Vol. 1: The United States. Export agreements, pricing, price discrimination, mergers, monopolies, anti-trust laws, etc. \$6.75 a copy in Canada, \$8.10 outside. Cat. No. RG 52-6/1976-1. Vol. 2: European Economic Community, Australia, Japan, Sweden, United Kingdom, West Germany. \$6.75 in Canada, \$8.10 outside. Cat. No. RG 52-6/1976-2.

**Land Use Programs in Canada.** \$1.25 in Canada, \$1.50 outside. When complete, this series will give an over-view of land use planning in Canada. Cat. No. EN 73-1/6.

**Trade of Canada – Exports by Commodities.** Monthly. Bilingual. 80¢ a copy, \$8 per year. Cat. No. CS 65-004.

## OTHER PUBLICATIONS

**Annual Report, Farm Credit Corporation.** Farm Credit Corporation, Box 6309, Station J, Ottawa, K2A 3W9.

**Canada Agriculture in 2001, A Strategy for Development.** Agricultural Economics Research Council, 100 Bronson Ave., Suite 203, Ottawa, K1R 6G8. Address by Dr. Gordon McEachern, President, Agricultural Economics Research Council.

**Part-time Farming: Problem or Resource in Rural Development.** Proceedings of first rural geography symposium, University of Guelph, June 1975. Department of Geography, University of Guelph, Guelph, Ontario. N1G 2W1.

**Productive Measurement in Socialist Economies Using Divisia Indexes and Adjusted Factor Shares.** University of Windsor, Department of Economics. Reprint Series. Serial no. 94. University of Windsor, Ontario.

**Agricultural Finance Statistics.** U.S. Department of Agriculture, July 1976. Real estate debts, farmers' home administration, loans, farm credit system, interest and money rates.

*Order from Publications Unit, Information Division, Economic Research Service, U.S. Department of Agriculture; Washington, D.C., 20250, U.S.A. Publication No. AFS-3.*

## IN REPLY

Yves Lauzon, an agronomist from Notre-Dame-du-Lac, Quebec, comments on two articles in the April issue: Canada's Pasture Potential and Farm Business Management Training. "I work as a local management counsellor in a marginal county," he writes. "I feel the need for better training in management in general and in financial management in particular." He has used this issue to make contact with thinkers and planners throughout the country, and for his own personal training. Why, he wonders, do economists not have more influence on the agricultural policies of our country?

G  rard B  lair, an economist with l'Alliance Transk  bec food markets, Montreal, writes that he found the April article on Demand Projections for Agricultural Commodities "very scientific and valuable for forecasting our market possibilities. . . . I propose," he says, "to inform our buyers of these forecasts, and since I am also a teacher I shall draw this article to the attention of my students."

A.G. Davis, professor of agriculture at the University of Rhodesia, in Salisbury, found the April article on Palm Oil in World Markets a "well-balanced presentation of the subject and its relation to other oils. The set of 11 factors listed on page 12 demonstrates what can be done within Third World agriculture whose production is supported by government." He suggests the author refer to Harold Wilson's "The Labour Government 1964-70," pages 598-600. The authors have received these comments. Professor Davis congratulated the authors of the April article on Canada's Pasture Potential for "providing a sound and practical assessment of prairie potential." He explains that he was born and raised on a ranch south of Medicine Hat. "The existence of

17.2 million acres of abandoned land in the eastern half of Canada plus a substantial area of abandoned farms on the prairies," he writes, "is a timely reminder to Canadians serving abroad to be very careful about giving farming advice. Africa is littered with failed development schemes based upon foreign expertise."

Stephen Thompson, a farmer near Clinton, Ontario, has worked for the Farm Credit Corporation and has lectured on agricultural finance. He writes that he used the June issue "mainly to find out about other publications which are of interest. Because I am farming I do not always know about new publications from federal, provincial or private sources. Therefore, I check the references given for articles written here. Furthermore, I would like to know about publications in other provinces and disciplines (e.g., sociology, business) which pertain to economics."

W.G. Freeman, author of "An Introduction to the Agriculture-Population Linkage Program" in the February issue, was not able to reply to a comment from Robert N. Plank of Kelowna, B.C., when it was received. He now sends his response. Mr. Plank noted that the article raised questions and implied possibilities for research. He wonders if the census definition of 'farm' is realistic for 1971? (It seemed to him more suited to 1871.) He also asks the following questions: (1) Should not many of these farmers be re-defined as 'tax-loss' farmers, capital-gain harvesters, or rural gentry? (2) Is a university degree detrimental to profitable farming (see Table 4) or is this just evidence of tax-loss farming? (3) Why are there so many land owners (census farmers) whose principal concern is not farm income? Are they supplementing their incomes with farm production, are

they investing in land for capital gain, are they reaping municipal tax benefits conferred upon 'farms' in certain areas? and (4) What effect does 'subsidized farming' (i.e., tax privileges granted to owners of 'farm' properties or 'farm' businesses) have upon commercial farmers principally occupied in farming? Recently I have read two articles in U.S. publications suggesting that special tax privileges granted to farmers may be hurting those whom they were intended to benefit. The Economics Branch of Agriculture Canada is in a good position to take a dispassionate look at these questions of importance to the health of the agricultural industry."

To this the author, W.G. Freeman, replies: "I agree with your observation. The purpose of the article was to give readers an indication of the research possibilities inherent in the Agriculture-Population Linkage Program. The program can be of assistance in exploring many of the questions you have raised. A substantial amount of analysis has already been completed by researchers in government departments and universities."

Thanks for comments on the June issue from L.E. Doucette, district manager of the Veterans Land Act, Rothesay, New Brunswick.

## **CORRECTION**

### **Volume II, Number 4, August 1976**

Page 10, Table 2. Under the heading Co-operative Share of the Market, the dairy product figure for 1974 should be 59 and for 1961, 46. The poultry and egg figure for 1974 should be 14, and for 1961, 15.

**IN REPLY TO AUTHORS AND EDITORS REGARDING OCTOBER 1976**  
*CANADIAN FARM ECONOMICS*

I have read one or more of the following articles:

- (1) Energy Use in Crop Production in Prince Edward Island
- (2) Agricultural Productivity in Eastern Canada
- (3) Changes in Food Expenditure Patterns, 1969-1974

- 1. My comments are on article number (1) (2) (3) (4)
- 2. On a scale of one to ten how useful was this article to you?  
not useful 12345678910 very useful.

- 3. Why?
- 4. How useful was the whole issue to you?
- 5. Do you have any suggestions or questions on the content of this issue?

How do you use this publication?

My comments may ( ) may not ( ) be used in a future issue of this publication. A copy of your comments will be forwarded to the author.

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OTTAWA, Ontario,  
Canada,  
K1A 0C5



# CONVERSION FACTORS FOR METRIC SYSTEM

| Imperial units         | Approximate<br>conversion factor   | Results in:                          |
|------------------------|------------------------------------|--------------------------------------|
| <b>LINEAR</b>          |                                    |                                      |
| inch                   | x 25                               | millimetre (mm)                      |
| foot                   | x 30                               | centimetre (cm)                      |
| yard                   | x 0.9                              | metre (m)                            |
| mile                   | x 1.6                              | kilometre (km)                       |
| <b>AREA</b>            |                                    |                                      |
| square inch            | x 6.5                              | square centimetre (cm <sup>2</sup> ) |
| square foot            | x 0.09                             | square metre (m <sup>2</sup> )       |
| acre                   | x 0.40                             | hectare (ha)                         |
| <b>VOLUME</b>          |                                    |                                      |
| cubic inch             | x 16                               | cubic centimetre (cm <sup>3</sup> )  |
| cubic foot             | x 28                               | cubic decimetre (dm <sup>3</sup> )   |
| cubic yard             | x 0.8                              | cubic metre (m <sup>3</sup> )        |
| fluid ounce            | x 28                               | millilitre (ml)                      |
| pint                   | x 0.57                             | litre (ℓ)                            |
| quart                  | x 1.1                              | litre (ℓ)                            |
| gallon                 | x 4.5                              | litre (ℓ)                            |
| <b>WEIGHT</b>          |                                    |                                      |
| ounce                  | x 28                               | gram (g)                             |
| pound                  | x 0.45                             | kilogram (kg)                        |
| short ton (2000 lb)    | x 0.9                              | tonne (t)                            |
| <b>TEMPERATURE</b>     |                                    |                                      |
| degrees Fahrenheit     | (°F-32) x 0.56<br>or (°F-32) x 5/9 | degrees Celsius (°C)                 |
| <b>PRESSURE</b>        |                                    |                                      |
| pounds per square inch | x 6.9                              | kilopascal (kPa)                     |
| <b>POWER</b>           |                                    |                                      |
| horsepower             | x 746<br>x 0.75                    | watt (W)<br>kilowatt (kW)            |
| <b>SPEED</b>           |                                    |                                      |
| feet per second        | x 0.30                             | metres per second (m/s)              |
| miles per hour         | x 1.6                              | kilometres per hour (km/h)           |
| <b>AGRICULTURE</b>     |                                    |                                      |
| gallons per acre       | x 11.23                            | litres per hectare (ℓ/ha)            |
| quarts per acre        | x 2.8                              | litres per hectare (ℓ/ha)            |
| pints per acre         | x 1.4                              | litres per hectare (ℓ/ha)            |
| fluid ounces per acre  | x 70                               | millilitres per hectare (ml/ha)      |
| tons per acre          | x 2.24                             | tonnes per hectare (t/ha)            |
| pounds per acre        | x 1.12                             | kilograms per hectare (kg/ha)        |
| ounces per acre        | x 70                               | grams per hectare (g/ha)             |
| plants per acre        | x 2.47                             | plants per hectare (plants/ha)       |

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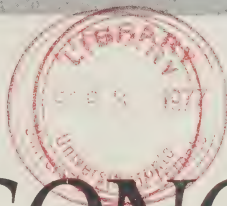
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VOLUME 11

NUMBER 6

DECEMBER 1976

# CANADIAN FARM ECONOMICS



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Agriculture  
Canada

HON. EUGENE WHELAN, MINISTER — L. DENIS HUDON, DEPUTY MINISTER

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**Letters from readers:** Letters are encouraged and should be addressed to the author or the Managing Editor. Responses...comments, suggestions and points of view are important for effective two-way communications. Letters may be used in the following issue of CFE and will be edited prior to publication where necessary.

# FARM MACHINERY



A.N. Book\*

*Increased production capacity allowed North American farm machinery manufacturers to meet demand in 1976, when sales exceeded 1975 levels in both value and unit terms. Sales are likely to be lower in 1977 because of lower 1976 farm income prospects and the fact that stocks of machinery on farms have been replenished in the past few years. The reduced demand plus the better supply-demand balance will mean a lower rate of increase in prices and an increase in inventories in 1977.*

## INTRODUCTION

Farm machinery and related expenditures represent a large and increasingly important part of total expenditures of Canadian farmers. Machinery operating and depreciation costs have accounted for a fairly constant 30 percent of total farm input costs over the last quarter century. But the key to the growing importance of machinery is its labor-saving properties. Measured in 1961 machinery prices, investment in machinery per farm worker has increased over 130 percent since 1951; in current dollars, it has risen more than 400 percent.

Since 1973, farmers have been replenishing their machinery stocks which had declined during the previous five years, and this action has been reflected in the size of machinery sales. The present sales boom actually began in 1971 but sales had declined to such a depressed level by 1970 that during the first two years of the upturn, the depreciation of machinery on farms exceeded the value of purchases. However, between 1970 and 1973 the demand for machinery rose so rapidly that manufacturers found themselves short of supplies and plant capacity. Therefore, they began an

intensive capital expansion program. In the interim, prices rose as farmers were willing to pay higher prices for scarce machinery and manufacturers paid more for inputs needed to produce the equipment ordered by their customers. By 1975 the situation had begun to change. Production had risen to a point where supplies were almost sufficient to meet the demands of farmers at prevailing price levels. And in 1976, supply and demand reached a reasonable balance.

This paper describes the farm machinery situation in 1976 and forecasts demand and supply for 1977. The first section examines the factors underlying the demand for machinery in 1976, presents some of the characteristics of the market and provides an estimate of total sales. The second section describes events relevant to the demand for machinery in 1977; these events are the bases for forecasting machinery sales in that year.

## SITUATION

Contrary to 1975 expectations of weakening 1976 farm machinery and repair part sales in Canada, this year's dollar and unit sales probably will be higher than they were last year. Total dollar sales of machinery and parts for the first eight months of 1976 exceeded the total during the same period of 1975 by about 23 percent (Table 1). Even if sales during the last four months only equal 1975 sales for the period, the 1976 total will reach

\*A.N. Book is an economist in the Marketing and Trade Division, Economics Branch, Agriculture Canada, Ottawa.

\$1,273 million, which is about 15 percent above the 1975 sales level (Table 1).

A similar estimate was derived from a linear equation relating farm machinery sales in one year to machinery price levels in the same year and to realized net farm income and machinery sales in the previous year<sup>1</sup>. If the historical relationships underlying this equation hold true, machinery sales (excluding repair parts) in 1976 will be over \$1,124 million. And if repair parts follow the pattern set in the first eight months of 1976 when they were 14 percent as large as machinery sales, total machinery and repair part sales will reach \$1,282 million, 15 percent higher than in 1975. When an average price change of about 8 percent between 1975 and 1976 is allowed for, the results indicate that the physical volume of sales<sup>2</sup> will have risen by about 7 percent for the year.

The farm machinery market has not been completely free of problems this year. Several factors, some of them predicted, have held sales in check. Machinery prices have risen an average of over 8 percent (Table 1, Figure 4). The reduction of dairy quotas has cut farm incomes and expectations, especially in Quebec and Ontario; a weak beef cattle market and poorer prairie hay crops have reduced incomes and the demand for haying machinery; and finally, minor supply shortages have occurred in some equipment lines such as combines (especially pull-type) and tractors with 80 to 100 hp. However, these obstacles have not been severe enough to counteract other forces that have been causing a continuation of the strong demand for machinery throughout Canada.

The farm machinery market has continued to be unexpectedly good this year for several reasons. Perhaps the most important is that the capital replacement and intensification program undertaken by farmers in the early 1970s had not peaked in 1975 as was believed last

year. Since unusually high net realized farm incomes were coupled with machinery supply restrictions from 1973 to 1975 (Figures 1 and 3), farmers had neither exhausted their accumulated financial resources nor satisfied their desires for new machinery by the end of 1975. Likewise, the farm implement manufacturing industry, with its recently expanded production base and at the expense of inventory building (Figure 3), has been able to meet most of the apparent backlog of farmers' demands in 1976. Thus, large tractors, combines, and complementary equipment were more readily available for purchase by farmers who had been unable to obtain these items in 1975.

The trend toward large tractors has been a major factor contributing to the increase in total machinery sales in 1976 (Table 1). As farmers favored larger machines, sales of tractors under 40 hp declined in all provinces. Conversely, unit sales of two- and four-wheel drive tractors of 80 hp and over rose 10 percent in Canada in the first eight months of this year and were the most popular tractors in the Prairies. Their share of total unit tractor sales in this period increased from 44 percent in 1975 to 47 percent in 1976 in Canada as a whole and from 71 to 72 percent in the Prairies. The largest rise in sales in Canada (over 19 percent) was recorded for tractors with 40 to 79 hp. This was the predominant size of tractor sold in Quebec and Ontario, representing 76 and 63 percent, respectively, of total unit tractor sales in these provinces. It was mainly because of increased sales in these two provinces that national sales of units in this power range rose so sharply. They represented 46 percent of total unit sales in the first eight months of 1976 compared with only 41 percent in the same period of 1975.

Because of high 1975 incomes and the impact of record grain harvests in the Prairies, combine sales also are expected to be higher this year across Canada. They were 29 percent higher in Canada in the first eight months of 1976 than in the same period of 1975 (Table 1).

Both new and used combines were in heavy demand this year in the Prairie Provinces where eight-month sales of new self-propelled combines leaped 31 percent. However, the pressure on combine supplies caused no serious problems during the harvest. Favorable weather conditions tended to diminish the need for additional machines and shortages that did materialize were met by farmers pooling their equipment. With the large 1976 prairie grain crops and tight combine supplies in mind, farmers will likely continue their purchasing of available machines, in the last four months of this year, despite the currently weaker grain price prospects.

<sup>1</sup> The equation, developed by I.F. Furniss of the Economics Branch, Agriculture Canada, is based on annual data for all of Canada covering the 1960-75 period. It is simply a description of average historical relationships and represents neither a pure demand nor a pure supply function. The coefficient of determination ( $R^2$ ) was 0.97, indicating that much of the variation in machinery sales is explained within the equation. However, it should be noted that there were unresolved problems of multicollinearity among the independent variables. The equation is as follows:

$$M_t = -148.7169 + 1.1176 P_t + .2039 Y_{t-1} + .2032 M_{t-1}$$

Where  $M_t$  = machinery dollar sales in year  $t$   
 $P_t$  = machinery price index (1961=100) in year  $t$   
 $Y_{t-1}$  = realized net farm income in year  $t-1$   
 $M_{t-1}$  = machinery dollar sales in year  $t-1$ .

<sup>2</sup> Includes quality and quantity changes.

**TABLE 1. ANNUAL CANADIAN FARM MACHINERY SALES, PRICES AND INTERNATIONAL TRADE: 1964-76**

|                                       |        | Average<br>1964-68 | Average<br>1969-73 | 1973   | 1974   | 1975                 | Partial Years |                   |
|---------------------------------------|--------|--------------------|--------------------|--------|--------|----------------------|---------------|-------------------|
|                                       | Units  |                    |                    |        |        |                      | 1975          | 1976 <sup>P</sup> |
| January to August                     |        |                    |                    |        |        |                      |               |                   |
| Sales <sup>a</sup>                    |        |                    |                    |        |        |                      |               |                   |
| New Machines                          | Mil.\$ | 385.1              | 388.7              | 573.9  | 713.7  | 966.3                | 608.5         | 766.4             |
| Repair Parts                          | Mil.\$ | 59.3               | 80.6               | 107.3  | 132.2  | 144.0                | 105.9         | 110.8             |
| Total                                 | Mil.\$ | 444.4              | 469.3              | 681.2  | 845.9  | 1,110.3              | 714.4         | 877.2             |
| Wheel Tractors                        | No     | 27,558             | 21,799             | 28,758 | 29,995 | 32,665               | 19,962        | 20,924            |
| — Under 80 h.p.                       | No     | 20,344             | 14,220             | 16,848 | 17,223 | 17,764               | 11,164        | 11,195            |
| — 80 h.p. and over                    | No     | 7,214              | 7,579              | 11,910 | 12,772 | 14,901               | 8,798         | 9,729             |
| Combines (S.P.)                       | No     | 7,042              | 3,120              | 3,930  | 3,749  | 4,144                | 2,294         | 2,963             |
| Balers (Hand<br>Portable Balers)      | No     | 10,567             | 7,477              | 7,610  | 6,960  | 6,686                | 5,274         | 5,078             |
| Second Quarter                        |        |                    |                    |        |        |                      |               |                   |
| Farm Input Price Indexes: 1961 = 100  |        |                    |                    |        |        |                      |               |                   |
| All Machines                          | Index  | 119.0              | 137.8              | 145.8  | 162.7  | 189.2                | 186.5         | 201.9             |
| Repairs <sup>b</sup>                  | Index  | 113.9              | 136.5              | 145.9  | 162.4  | 185.1                | 183.2         | 197.6             |
| All Inputs                            | Index  | 117.1              | 141.1              | 166.7  | 195.2  | 215.9                | 212.8         | 226.9             |
| January to August                     |        |                    |                    |        |        |                      |               |                   |
| Foreign Trade in Farm Machinery       |        |                    |                    |        |        |                      |               |                   |
| Total Imports                         | Mil.\$ | 348.3              | 370.9              | 541.5  | 771.9  | 1,083.4 <sup>c</sup> | 881.7         | 924.8             |
| Total Exports                         | Mil.\$ | 171.5              | 214.7              | 302.5  | 415.3  | 574.6 <sup>c</sup>   | 364.3         | 379.1             |
| Net Trade Balance                     | Mil.\$ | -176.8             | -156.2             | -239.0 | -356.6 | -508.8               | -517.4        | -545.7            |
| Percent of Total Imports<br>from U.S. | %      | 90.6               | 86.0               | 86.8   | 87.5   | 86.6                 | n.a.          | n.a.              |
| Percent of Total Exports<br>to U.S.   | %      | 92.3               | 94.6               | 94.4   | 93.6   | 86.4                 | n.a.          | n.a.              |

<sup>a</sup>Valued at dealers' buying prices before deduction of dealers' cash discounts.

<sup>b</sup>Includes tires, batteries and repairs.

<sup>c</sup>In 1975, a large number of machines in transit through Canada were classed as imports. Some of these were also classed as exports. Consequently, imports and exports may be overstated by 10 and 3 percent respectively in 1975.

<sup>P</sup>Preliminary

Sources: (1) Statistics Canada, Farm Implement and Equipment Sales, Cat. No. 63-203 Annual and 63-009 Monthly.

(2) Statistics Canada, Farm Input Price Index, Cat. No. 62-004 Quarterly.

(3) Statistics Canada, Trade of Canada, Imports by Commodities, Cat. No. 65-007 and Exports by Commodities, Cat. No. 65-004.

(4) Statistics Canada, Daily, Sept. 24, 1976, Cat. No. 11001-E.

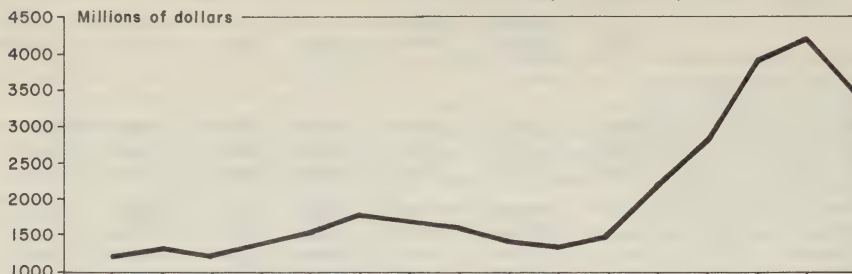
Canada-wide conventional baler sales<sup>3</sup> continued their downward slide in 1976 (Table 1). This decline reflected the drop in unit sales on the Prairies. The eight-month Prairie sales level was 30 percent lower in 1976 than in 1975, overshadowing a 30-percent increase in the rest of Canada. The fall in Prairie sales was caused by the continuing substitution of conventional balers with large round balers as well as by this year's smaller hay crop and the continuing poor cattle market. No improvement in sales is expected in the last few months of 1976.

On average, purchases of other farm machinery were brisk in 1976. The proportion of total machinery sales accounted for by equipment other than tractors and combines does not vary greatly from one year to the next (Table 2). Much of the demand for equipment is a function of economic conditions on farms. Since total machinery sales are expected to rise in 1976, total sales of machinery not specifically mentioned above also will be higher.

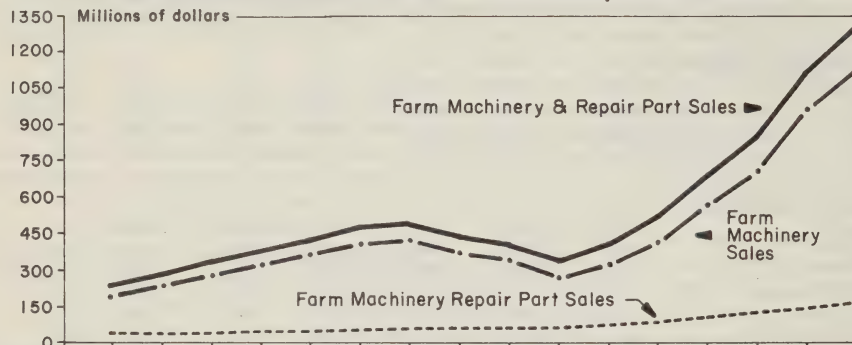
The Atlantic Provinces are the only provinces in which serious complaints about repair parts availability and service arose in 1976. In other areas, no significant repair

<sup>3</sup>Conventional balers are balers that produce hand-portable bales.

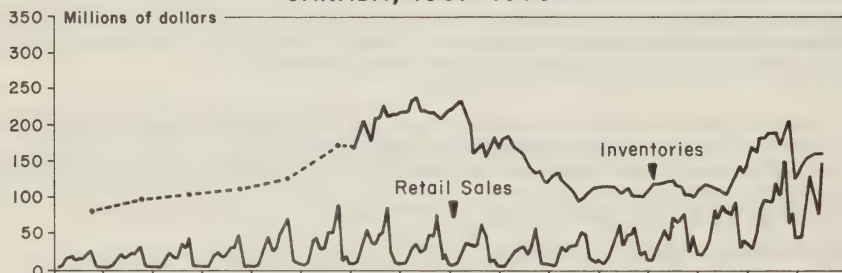
### ANNUAL REALIZED NET FARM INCOME, CANADA, 1961 - 1976



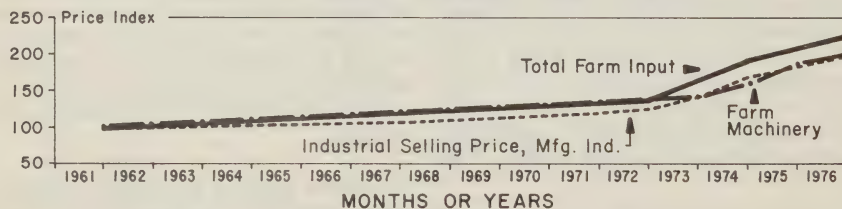
### ANNUAL RETAIL FARM MACHINERY AND REPAIR PART SALES IN CANADA AT DEALER'S BUYING PRICES, 1961 - 1976



### MONTHLY FARM MACHINERY DEALER SALES AND INVENTORIES IN CANADA, 1961 - 1976



### ANNUAL PRICE INDEXES : 1961 - 1976



Source: See Table I; Also Statistics Canada Cat. Nos. 63-008; 63-521 and 21-202.

TABLE 2. SALES OF SELECTED NEW FARM MACHINERY IN CANADA: 1964–75

| Year            | Tractors <sup>a</sup> |                      | Combines <sup>b</sup> |                      | Haying Equipment <sup>c</sup> |                      | Plows <sup>d</sup> |                      | Tillage Machinery <sup>e</sup> |                      | Total machinery Sales |
|-----------------|-----------------------|----------------------|-----------------------|----------------------|-------------------------------|----------------------|--------------------|----------------------|--------------------------------|----------------------|-----------------------|
|                 | Mil.\$                | Percent of all Sales | Mil.\$                | Percent of all Sales | Mil.\$                        | Percent of all Sales | Mil.\$             | Percent of all Sales | Mil.\$                         | Percent of all Sales | Mil.\$                |
| Average 1964–68 | 127.6                 | 33.1                 | 67.4                  | 17.5                 | 29.0                          | 7.5                  | 17.9               | 4.7                  | 27.2                           | 7.1                  | 385.1                 |
| Average 1969–73 | 131.6                 | 33.9                 | 42.0                  | 10.8                 | 27.6                          | 7.1                  | 10.6               | 2.7                  | 24.5                           | 6.3                  | 388.7                 |
| 1972            | 151.3                 | 36.0                 | 42.9                  | 10.2                 | 29.7                          | 7.1                  | 11.5               | 2.7                  | 26.1                           | 6.2                  | 420.2                 |
| 1973            | 208.2                 | 36.3                 | 67.2                  | 11.7                 | 41.5                          | 7.2                  | 13.5               | 2.4                  | 39.4                           | 6.9                  | 573.9                 |
| 1974            | 239.1                 | 33.5                 | 69.1                  | 9.7                  | 49.4                          | 6.9                  | 18.4               | 2.6                  | 54.5                           | 7.6                  | 713.7                 |
| 1975            | 349.2                 | 36.1                 | 108.2                 | 11.2                 | 65.0                          | 6.7                  | 25.5               | 2.6                  | 78.5                           | 8.1                  | 966.3                 |

<sup>a</sup>All farm wheeled tractors excluding attachments sold separately.

<sup>b</sup>All combines excluding accessories and parts sold separately.

<sup>c</sup>Includes mowers, rakes, conditioners, balers, etc.

<sup>d</sup>Includes mold board and disc plows, diskers, rotary tillers, etc.

<sup>e</sup>Includes harrows, rotary hoes, pulverizers, cultivators (excluding rotary), rod weeders, etc.

Source: Statistics Canada, Farm Implement and Equipment Sales, Cat. No. 63-203 Annual.

part shortages have been reported. The availability of parts apparently has improved over last year even though total dealer inventories of machinery and parts have fallen in Canada<sup>4</sup> (Figure 3). The production capacity of manufacturers, in conjunction with inventories that had begun to build in 1975 (Figure 3), was sufficient to meet the demand for most machinery and repair parts. Procurement problems faced by manufacturers in previous years were no longer significant. Even the U.S. tire strike had little effect on the implement industry, although supply constraints began appearing in the last quarter. Therefore, a machinery and parts supply-demand balance seems to have been reached in 1976 after several years of supply shortages.

This balance of farm machinery supply and demand, and the general slackening of inflation in the economy, has led to a decline in the rate of price increases for farm implements and parts in 1976 (Figure 4 and Table 1). Although the average annual price change was still greater than the 6.6-percent average price rise for all farm inputs (Table 1), the difference between the two has narrowed considerably since last year when there was a 5.7-percent spread. Total machinery retail prices from second quarter to second quarter rose only 8.3

percent between 1975 and 1976 as opposed to 18.6 percent between 1974 and 1975. Prices of tractors and other power machinery increased as much as 9 percent, well below the 20.6-percent rise between 1974 and 1975. All machinery and parts prices rose less between 1975 and 1976 than they did between 1974 and 1975.

Much of the movement in Canada's farm machinery and parts prices and supplies can be linked closely to international price changes because Canada depends so heavily on imports to meet its farm machinery needs. Canada has continued to be a net importer of such equipment and the trade deficit has been growing steadily since 1965 (Table 1). Over 80 percent of Canadian farm machinery purchases are imports and 85 to 95 percent of these are from the United States, Canada's dominant trading partner in both exports and imports of farm machinery (Table 1).

Since Canada has a free trade agreement in farm machinery with the United States and since so much of Canada's trade is with that country, machinery prices, supplies and trends south of the border are important factors to consider in assessing the Canadian market. The 1976 machinery market situation in the United States was very similar to that in Canada. In the first half of 1976 annual price increases were roughly the same and moderating, supplies were adequate, and sales were above 1975 levels. The primary differences between the two countries were that the percentage increase in sales

<sup>4</sup>Since repair parts are only a small portion of total inventories, supplies of these items might have risen while inventories of machinery fell.

was much greater in Canada and that U.S. dealer inventories were slightly above 1975 levels, not below as they were in Canada. With the free movement of machinery between countries, both factors will tend to mitigate against the possibility of serious machinery shortages developing in Canada during the remainder of this year.

## OUTLOOK

The peak of the current machinery sales boom seems likely to have been reached in 1976. There are two principal reasons for predicting the end of the six-year expansion of sales. One is that farmers have almost completed their cyclical machinery stock-building program. The other is that net realized farm incomes have fallen this year.

Several prime indicators suggest that farmers' machinery accumulation drive is nearing an end and that fewer machines will be bought in 1977. First, dealers have had to work much harder to sell their machines in 1976. Second, farmers reportedly are becoming more cautious buyers and doing more comparative shopping. Third, the rate of increase of machinery sales has fallen. Finally, the decline in the ratio of depreciation of machinery on farms to total machinery sales has slowed significantly and will have bottomed out at 0.74/1.0 in 1976 after falling steadily since 1971. This ratio will then be at its lowest point since 1950. All of these factors indicate that 1976 is a turning point and that sales will not be as strong in 1977 as they were in 1976.

Lower 1976 net realized farm incomes also foreshadow declining 1977 machinery sales. As mentioned previously, a strong statistical correlation exists between one year's farm machinery sales and the previous year's net farm income<sup>5</sup>. Such a correlation is to be expected because farmers tend to be conservative, buying equipment when they have a sound cash basis. Thus, a major factor in their decision to buy needed machinery is the assurance that they have the required funding. And in most cases, they will depend heavily on income earned in the previous period for this funding.

If the average relationship described by the equation presented in the first section of this paper holds true for 1977, if machinery prices rise a moderate 6 percent, and

if 1976 net realized farm income is \$3,459.6 million<sup>6</sup>, then 1977 machinery sales (excluding repair parts) will be \$1,024 million, 9 percent lower than 1976. Assuming 1977 repair part sales are 17 percent as large as machinery sales (as they were during the first year following the 1967 sales peak), they will be \$174 million. Total machinery and part sales will then be \$1,198 million, 7 percent lower than in 1976. In terms roughly equivalent to 1976 physical sales, they will decline 12 percent in 1977.

The drop in 1977 machinery sales does not signify a decline in the value of machinery on farms. Farmers will still be building up their machinery stocks somewhat next year. Not until 1978 will farmers merely be replacing their depreciating equipment or letting the total value fall, depending on the level of farm income in 1977; that is, if net farm income is much lower in 1977 than in 1976, the machinery stock probably will fall.

In subsequent years, farmers likely will allow the total value of machinery on farms to decline until favorable net farm incomes enable them to replace their aging stock once again.

Not all machinery sales will fall in 1977. Dealers have reported that the demand for grain combines and certain tractors over 80 hp was very high in 1976 and they expect this to continue into 1977. Also, since new concepts in the separating and threshing functions of combines recently have been developed, the demand for combines might continue strong for several years. However, sales of most machinery will probably decline.

A lower rate of inflation in Canada in 1977, coupled with the slackening demand for and improved supply of farm machinery should result in a declining rate of machinery price increases in 1977 compared with 1976. In recent years of scarce supplies, dealers' retail prices apparently were fairly rigid. With supplies rising to meet the strong demand in 1976, prices had begun to soften, and it is expected that the shift from a seller's to a buyer's market will have been completed in 1977. Consequently, in the retail market, well-bargained prices of specific types of machinery might even be lower in 1977 than in 1976. In the United States, an August prediction said that the U.S. rate of machinery price increases would fall to a level equal to the average industrial commodity price change<sup>7</sup>. The 6-percent rate of price increase assumed in making 1977 sales

<sup>6</sup> Agriculture Canada prediction made in October, 1976.

<sup>5</sup> This relationship has been described in the equation mentioned in the first section of this paper.

<sup>7</sup> Paper given at the Midwest Agricultural Outlook Conference, August 25, 1976, East Lansing, Michigan.

predictions for Canada in this paper is above the 1976 average Canadian industrial commodity rate but lower than the expected 1975 to 1976 average machinery price rise of 8 percent.

The predictions of larger farm machinery inventories and lower rates of price increases could prove wrong if farm machinery manufacturing firms cut production too drastically. These companies do not want to have to maintain the large inventories they did in the last half of the 1960s. Since 1976 inventories had already begun to grow in the United States and since dealers have a pessimistic view of 1977 sales prospects, manufacturers will probably be producing at below capacity next year. However, if they reduce their production too much, a supply shortage could develop and prices may rise accordingly. But barring such a tactic on the industry's part, prices and supplies should be better in 1977 than they were in 1976 from the buyer's viewpoint.

One exception to the favorable outlook for the supply of machinery and repair parts will be the availability of tires. Because of the strikes against tire producers in the United States, inventories fell sharply during 1976. In the last quarter of 1976, supplies were tight and prices had begun to firm up. These tight supplies and firm prices are expected to continue until the end of 1977. Shortly after that, a surplus should develop and prices should soften since North American tire manufacturers recently expanded their plants and now have an ample production base.

A good indication of the farm machinery industry's anticipation of the 1977 market is provided by the Canadian Farm and Industrial Equipment Institute (C.F.I.E.I.) in its recent forecast, "Industry Outlook 1977". This forecast presents the median values of estimates provided by its members in response to the institute's annual market survey. In the survey, members were asked to estimate 1976 and project 1977 unit sales of selected equipment. Their responses are given in columns 3 and 5 of Table 3.

The C.F.I.E.I.'s survey of unit sales reflects anticipated reactions of farmers to both this year's crop and farm product prices and next year's expected conditions. Institute members predict lower unit sales of tractors under 80 hp because of the effect of reductions in dairy quotas on Quebec and Ontario as well as poor cattle markets. They anticipate only a small increase in sales of two-wheel-drive tractors with 80 hp and over due not only to the dairy quota cuts and poor cattle markets but also to slightly lower 1976 net incomes of grain farmers and the build-up of tractor stocks on farms over the past few years. They expect four-wheel-drive tractor unit

sales to rise again in 1977 as these machines continue displacing two wheel-drive tractors.

C.F.I.E.I. members anticipate that combine sales will remain strong in 1977 for reasons described previously. However, they predict a decline in self-propelled combine unit sales and a compensating increase in the sale of pull-type units. This forecast is based on the premise that there is a latent demand for pull-type combines by Prairie farmers interested in making full use of the new large tractors with electronic controls. Also, in part, it is a reflection of the "integrated system" approach. Prairie farmers have been encouraged to adopt over the years by economic conditions as well as by agricultural engineers.

C.F.I.E.I. members have varying expectations about unit sales of other machines. They feel some will rise as much as 4 percent while others will decline as much as 6 percent. However, most members believe 1977 will be generally a poorer year for sales than 1976 was.

To provide a basis of comparison with the projected 9-percent decline in 1977 dollar sales of machinery (excluding repair parts) described earlier, the C.F.I.E.I.'s unit estimates (Table 3) were converted into current dollar values. Average 1975 dealer buying prices of machines were calculated using data from Statistics Canada's annual estimate of farm machinery sales<sup>8</sup>. Then, these prices were increased in 1976 and 1977 to reflect rising prices (see Footnote c, Table 3). Finally, the dollar values of the institute's projected unit sales were calculated for 1976 and 1977.

The C.F.I.E.I. unit sales estimates imply that dollar sales for the selected machinery will be 14.6 percent higher in 1976 than in 1975 and 7.5 percent higher in 1977 than in 1976 (Table 3). However, sales of these selected machines accounted for only 58 percent of total sales in 1975. A better idea of their estimates of changes in total sales perhaps can be obtained by converting the values represented by the estimated tractor sales into total machinery sales on the basis of the relationships shown in Table 2. The results of this calculation, presented in Table 3, seem to indicate that C.F.I.E.I. members believe dollar sales will rise between 17 and 28 percent from 1975 to 1976 (an average of 22.5 percent) and between -1 and 18 percent from 1976 to 1977 (an average of 8.4 percent).

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<sup>8</sup>Statistics Canada, *Farm Implement and Equipment Sales - 1975*, Cat. No. 63-203.

**TABLE 3. PROJECTED 1977 SALES OF SELECTED FARM MACHINERY BASED ON C.F.I.E.I. MEMBER SURVEY RESULTS**

|   | 1975<br>Actual <sup>a</sup> |                    | 1976<br>Estimates         |                                | 1977<br>Projection        |                                |
|---|-----------------------------|--------------------|---------------------------|--------------------------------|---------------------------|--------------------------------|
|   | No. of Units                | Value<br>(Mil.\$)  | No. of Units <sup>b</sup> | Value <sup>c</sup><br>(Mil.\$) | No. of Units <sup>b</sup> | Value <sup>c</sup><br>(Mil.\$) |
| Wheeled Tractors  |                             |                    |                           |                                |                           |                                |
| 2-wheel Drive (under 80 h.p.)                                     | 17,764                      | 111.3              | 17,000                    | 120.9                          | 15,700                    | 119.9                          |
| 2-wheel Drive (80 h.p. and over)                                  | 12,096                      | 164.4              | 12,940                    | 203.3                          | 13,143                    | 227.6                          |
| 4-wheel Drive (Integral)  | 2,805                       | 73.5               | 2,900                     | 83.5                           | 3,100                     | 94.6                           |
| SUB TOTAL TRACTORS  | —                           | 349.2              | —                         | 407.7                          | —                         | 442.1                          |
| Combines, pull-type   | 1,968                       | 24.2               | 2,250                     | 30.1                           | 2,450                     | 34.8                           |
| Combines, self-propelled  | 4,144                       | 83.9               | 4,300                     | 94.7                           | 4,100                     | 95.7                           |
| Windrowers & P.t. swathers  | 3,442                       | 8.2                | 3,475                     | 8.9                            | 3,550                     | 9.7                            |
| Windrowers & S.P. swathers  | 5,307                       | 30.1               | 5,600                     | 34.6                           | 5,250                     | 34.4                           |
| Balers (hand-portable bales)                                      | 6,686                       | 19.5               | 6,200                     | 19.5                           | 6,050                     | 20.2                           |
| Balers (large round)  | 2,254                       | 10.2               | 2,500                     | 12.2                           | 2,600                     | 13.5                           |
| Corn Heads  | 842                         | 4.0                | 875                       | 4.4                            | 900                       | 4.8                            |
| Forage Harvesters (Shear Bar)                                     | 2,761                       | 10.6               | 2,620                     | 8.5                            | 2,530                     | 8.7                            |
| Manure Spreaders  | 6,384                       | 11.5               | 6,270                     | 12.1                           | 6,125                     | 12.5                           |
| Grain Drills (Press and end wheel)                                | 5,121                       | 13.3               | 5,265                     | 14.7                           | 5,330                     | 15.8                           |
| SUB TOTAL SELECTED MACHINES<br>EXCLUDING TRACTORS                 | —                           | 215.5              | —                         | 239.7                          | —                         | 250.1                          |
| TOTAL — ALL SELECTED MACHINES                                     | —                           | 564.7              | —                         | 647.4                          | —                         | 696.2                          |
| Percentage Change from Previous Year                              | —                           | —                  | —                         | 14.6                           | —                         | 7.5                            |
| Total All Canadian Sales if Tractors Equal<br>33 percent of Total | —                           | n.a.               | —                         | 1,235.5                        | —                         | 1,339.7                        |
| Total all Canadian sales if Tractors Equal<br>36 percent of Total | —                           | 966.3 <sup>d</sup> | —                         | 1,132.5                        | —                         | 1,228.1                        |

<sup>a</sup>Source: Statistics Canada, Farm Implement and Equipment Sales 1975, Cat. No. 63-203 Annual

<sup>b</sup>Canadian Farm and Industrial Equipment Institute Survey, 1976

<sup>c</sup>Figures for 1977 are based on assumed price changes of 6 percent for all machinery between 1976 and 1977, and those for 1976 reflect second quarter 1975 to second quarter 1976 changes reported in Statistics Canada Farm Input Price Index Cat. 62-004. In calculating the value of tractors, it was assumed that tractors would become more expensive between 1975 and 1977 both because they have been getting bigger and more complex and because of the general price rises mentioned above.

<sup>d</sup>In 1975, tractor sales represented about 36 percent of the total.

If given a choice of forecasts of the total value of 1977 sales based on C.F.I.E.I.'s unit tractor projections, most institute members probably would prefer the lower figure in Table 3. This preference was implied by their responses to questions in two separate sections of the institute's questionnaire. In one section, members indicated that they expected overall unit sales for machines other than tractors of 80 hp and over to decline. In the other, they revealed their anticipation of a poorer 1977 market when 43 percent reported that they were pessimistic about total 1977 industry sales prospects, 36 percent felt that there would be no change between 1976 and 1977 and only 21 percent were optimistic. Therefore, the lower projection of 1977 dollar sales given in Table 3 likely is more representative of the farm machinery industry's opinion than is the higher.

According to these calculations of 1976 and 1977 sales expectations, institute members believe that the physical volume of sales will change in the same direction in both 1976 and 1977 as was predicted using the equation described in footnote 1. However, the sizes of the changes and hence the dollar values of total sales expected by the members are greater than the equation-based estimates indicate they might be. For 1976, the institute's implied estimates of dollar sales are from 1 to 10 percent higher; for 1977, its preferred forecast is about 20 percent higher.

There are at least two reasons that might explain the differences between the institute's estimates and those derived with the predictive equation. The first is that the farm machinery industry may be unduly optimistic

about 1976 and 1977 sales. The second is that, since the equation-derived estimates represent "averages" of possible values, they could prove to be lower than actual sales, as is implied by the institute's forecast. For instance, if the equation had been used to predict annual sales from 1960 through 1975, actual sales would have deviated from the equation-derived forecast by more than 10 percent in six of the sixteen years. The largest difference would have been 15.7 percent. Therefore, much of the discrepancy between the institute and equation-derived estimates of 1976 and 1977 sales might be explained in terms of expected deviations from the "average".

A closing comment can be made on the estimates of the C.F.I.E.I. members and those based on the predictive equation. The results determined using the equation indicate that both unit and dollar sales will be substantially lower in 1977 than in 1976. The worst the industry expects is for unit, not dollar, sales to decline. This being the case, if the historical relationships underlying the equation hold true in 1977 and if the industry produces machinery to meet the median unit sales expectations of its members, then the forecasts of softening prices, increasing dealer inventories and improved machinery supplies in 1977 are certain to be borne out.

## SUMMARY

The farm machinery market was more buoyant in 1976 than was anticipated at this time last year. By the end of 1976, sales in both value and unit terms will have exceeded the 1975 level. Yet none of the serious shortages of the previous three or four years materialized in 1976 because the increased production capacity of the North American industry enabled manufacturers to meet the demand. Inventories in the United States even began accumulating, although no build-up was apparent in Canada by August, 1976. Both Canadian and U.S. farm machinery price increases were lower between 1975 and 1976 than between 1974 and 1975.

Indications are that 1977 machinery sales will be lower than in 1976 because of declining demand. Some of the more important reasons for the reduced demand are lower 1976 net farm incomes, uncertain 1976-77 grain markets, changes in 1976 dairy quotas, poor cattle markets, and the apparent peaking of the recent drive to

replenish farm machinery stocks. Since manufacturers now have the plant capacity to produce more machinery, inventories will probably increase in 1977 even though firms will not be producing at full capacity. As a result, the rate of increase of farm machinery prices should moderate. Some minor tire shortages may appear in 1977 because of the lengthy 1976 labor strike against tire producers in the United States. However, these shortages should disappear by the end of 1977 and most other repair parts will be readily available throughout the year. Repair part price increases should moderate to reflect these conditions.

## REFERENCES

1. Farm Input Situation and Outlook 1976-77. Paper prepared for Midwest Agricultural Outlook Conference, East Lansing, Michigan, August 25, 1976.
2. Free Press Report on Farming (various articles), Sept. 29, 1976, Winnipeg, Manitoba.
3. Industry Outlook 1977. Canadian Farm and Industrial Equipment Institute. Toronto, Ontario, November 1976.
4. Statistics Canada. Various publications - Cat. Nos.: 11-001E Daily (Sept. 24, 1976); 21-202 Annual; 62-004 Quarterly; 63-008 and 63-009 Monthly; 63-203 Annual; 63-521 Occasional; 65-004 and 65-005 Monthly.
5. Unpublished monthly letters on U.S. machinery market situation. Farm and Industrial Equipment Institute, Chicago, Illinois.

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# FERTILIZERS



*Fertilizer supplies for Canadian use in the 1976-77 fertilizer year will be adequate, with prices holding close to current levels. With current price prospects for grains, no increase in fertilizer demand is foreseen, assuming no change in fertilizer prices in the spring of 1977.*

*I.F. Furniss and C.D. Crober\**



## INTRODUCTION

Commercial fertilizers and agricultural limestone are relatively important inputs in Canadian agriculture. Expenditures by farmers rose from an estimated \$163.5 million in 1964-68, to \$170.3 million in 1969-73, and to over \$495 million in 1975. However, purchases in 1976 seem likely to have dropped below this level, although still in excess of \$400 million.

Fertilizer expenditures since 1964 have never been less than about 5 percent of total farm operating expenses and, in 1975, the proportion reached almost 9 percent, the highest for the period. Consumption on farms of the three primary plant nutrients, nitrogen (N), phosphates ( $P_2O_5$ ) and potash ( $K_2O$ ) has shown an annual growth rate of 6.8 percent since 1963-64<sup>1</sup>. Nitrogen consumption has increased most rapidly, 10.5 percent a year, followed by phosphates at 4.8 and potash at 4.1 percent.

In this paper the Canadian fertilizer supply, demand and price situation will be reviewed for the past fertilizer year and the outlook for 1976-77 analyzed. Some evaluation of the outlook to 1980-81 is included. Also,

there will be a brief overview of the world situation and outlook.

## WORLD SITUATION

FAO estimates early in 1976 indicate that world production of the three primary plant nutrients (NPK) reached 91.7 million tonnes in 1974-75 (fertilizer year ending June 30) or 4.4 percent more than a year earlier<sup>2</sup>. This increase was less than the 7.4 percent gain of the previous year. After accounting for estimated storage and handling losses, available supply was estimated at 86.8 million tonnes, only 3 percent more than in 1973-74. However, since world consumption dropped 2.4 percent to 81.7 million tonnes, world supplies exceeded demand by 5 to 6 percent. This was the first time since World War II that annual world fertilizer consumption decreased. The decline was caused by a 10-percent drop in consumption in the developed market economies.

International fertilizer prices fell rapidly in 1974-75 from the beginning of the fertilizer year<sup>4</sup>. Diammonium

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<sup>1</sup> Unless otherwise indicated, all growth rates are compound and based on a logarithmic regression of the data series with time.

<sup>2</sup> FAO, Monthly Bulletin of Agricultural Economics and Statistics, Vol. 25, No. 3, Rome, 1976. One tonne equals 1.1023 short tons (2,000 pounds) and one short ton equals .9072 tonnes.

<sup>3</sup> FAO/UNIDO/World Bank Working Group on Fertilizers.

<sup>4</sup> Richard B. Reidinger, World Fertilizer Review and Prospects to 1980-81, ERS/USDA, FAE Report No. 115, February 1976. Prices given are in U.S. dollars and f.o.b. major shipping points.

**TABLE 1. CANADIAN TRADE IN FERTILIZERS AND FERTILIZER MATERIALS, 1974-75 AND 1975-76 (YEARS ENDING JUNE 30)**

| Item  | United States |         |         |         | All Countries |         |         |         |
|---|---------------|---------|---------|---------|---------------|---------|---------|---------|
|   | Imports       |         | Exports |         | Imports       |         | Exports |         |
|   | 1974-75       | 1975-76 | 1974-75 | 1975-76 | 1974-75       | 1975-76 | 1974-75 | 1975-76 |
| — thousand short tons (2,000 lb) —                          |               |         |         |         |               |         |         |         |
| Anhydrous ammonia   | —             | —       | 104     | 132     | —             | —       | 104     | 132     |
| Urea  | 2             | 19      | 153     | 122     | 2             | 35      | 153     | 133     |
| Ammonium nitrate  | —             | —       | 208     | 200     | —             | —       | 208     | 201     |
| Sodium nitrate  | 7             | 11      | —       | —       | 15            | 18      | —       | —       |
| Ammonium sulphate   | 33            | 39      | 131     | 183     | 34            | 46      | 131     | 183     |
| Nitrogen solutions n.e.s.                                   | 8             | 19      | 101     | 98      | 8             | 19      | 102     | 98      |
| Ammonium phosphate and<br>Nitrogen fertilizers n.e.s.       | 11            | 27      | 381     | 368     | 14            | 27      | 558     | 477     |
| Phosphate rock  | 3,960         | 3,364   | —       | —       | 3,971         | 3,368   | —       | —       |
| Superphosphate, 22% or less P <sub>2</sub> O <sub>5</sub>   | 7             | 2       | —       | —       | 7             | 2       | —       | —       |
| Superphosphate, more than 22% P <sub>2</sub> O <sub>5</sub> | 25            | 48      | —       | —       | 25            | 48      | —       | —       |
| Phosphatic fertilizers n.e.s.                               | 73            | 129     | —       | —       | 75            | 130     | —       | —       |
| Potassium chloride (Muriate of Potash)                      | —             | 1       | 6,244   | 6,297   | —             | 1       | 9,010   | 7,939   |
| Potassium sulphate  | 18            | 8       | —       | —       | 18            | 8       | —       | —       |
| Potassic fertilizers n.e.s.                                 | 46            | 62      | —       | —       | 46            | 62      | —       | —       |
| Prepared fertilizer mixtures                                | 55            | 55      | 78      | 52      | 62            | 55      | 81      | 54      |
| Fertilizers n.e.s.  | 27            | 60      | 29      | 16      | 39            | 61      | 29      | 21      |
| — thousand dollars —  |               |         |         |         |               |         |         |         |
| All materials and mixtures                                  | 109,405       | 134,846 | 387,586 | 418,226 | 116,134       | 138,364 | 473,206 | 511,840 |

Source: Statistics Canada, Imports by Commodities, Cat. No. 65-007, Monthly, and Exports by Commodities, Cat. No. 65-004, Monthly.

(—) = Nil or 500 tons or less.

n.e.s. = not otherwise specified.

phosphate prices came down from over \$400 a tonne to less than \$200 and the decline continued into 1975-76. Potassium chloride (KCl), after peaking at about \$90 a tonne in early 1975, was down to \$70-\$80 a tonne (in bulk) by the end of the calendar year. The end of the 1975-76 fertilizer season on June 30 showed substantial stocks of potash in producers' inventories. Prices, both North American domestic and export, ranged from \$50-\$55 a tonne<sup>5</sup>. Even with the decline in fertilizer prices in 1974-75 continuing into 1975-76, world fertilizer consumption of NPK increased by less than 7 percent in 1975-76 while supply was expected to rise over 12 percent, resulting in a doubling of the net supply balance.

U.S. consumption in 1975-76, based on a 14-state total, increased 15 percent<sup>6</sup>. Consumption of phosphates (as primary materials) increased the greatest,

42 percent, followed by potash at 29 percent and nitrogen at 19. These increases followed a decline of 10 percent in total consumption in the previous fertilizer year.

Although U.S. fertilizer consumption was up sharply in 1975-76, Canadian exports of fertilizers and fertilizer materials to the United States increased modestly (Table 1). In value terms, exports to that market of total fertilizer products rose 8 percent but the volume of shipments increased less than 1 percent. Exports of muriate of potash are the most important item. In 1975-76 they totalled 6.3 million tons, almost 1 percent more than in 1974-75. Total fertilizer and material shipments to all other countries increased in value 9 percent but volume of shipments declined 40 percent due to decreased potash shipments. Canadian imports of fertilizers and materials in 1975-76 were valued at \$138 million, 19 percent more than in the previous year. The volume of imports was down 10 percent due to reduced imports of phosphate rock, but phosphatic fertilizer imports increased almost 70 percent.

<sup>5</sup> British Sulphur Corporation, Fertilizer International, Vol. 86, August 1976.

<sup>6</sup> Commercial Fertilizers, SRS/USDA, August 1976.

## WORLD OUTLOOK<sup>7</sup>

With the rapid growth of fertilizer inventories in exporting countries, availability of fertilizers in world trade improved greatly in 1975-76. For example, inventories of potash held by Canadian producers at the beginning of the 1976-77 fertilizer year amounted to over 1 million tons of  $K_2O$ , 58 percent more than a year earlier. Inventory growth in other exporting countries for nitrogen and phosphates has been large also.

In 1975-76, an 8.5-percent increase in world nitrogen consumption was forecast. Since the expected increase of 9 percent in world supply of nitrogen for 1976-77 will exceed the expected growth in consumption of 7 percent, a positive world balance of supply over demand will continue. However, much of the expected increase in supply depends on a 14-percent increase in capacity in developing countries. Nitrogen supplies are also expected to increase in the developed countries and in the centrally-planned economy countries, slightly increasing the surplus available for export. Exports from the centrally-planned economies are providing the main indicators of the levels of world fertilizer prices. For example, urea from Poland has been sold in bags at less than \$100 a tonne<sup>8</sup>. The strengthening of the U.S. market for nitrogen kept international nitrogen prices from falling lower than they otherwise would have in 1975-76. Continuation of a positive supply balance depends also on a continued relative weakness in demand, which in turn depends heavily on the grain supply and price situation. With the larger grain crops of the past two years in the major exporting countries, grain prices will probably remain below the highs of two years ago.

In 1975-76, an increase of nearly 4 percent was expected in world phosphate consumption and 11 percent in supply. This will mean the continuation of a large positive supply balance well into 1976-77, although consumption is expected to increase 7 percent and supply 6 percent. There are indications, however, that the downward trend in both phosphate rock and phosphatic fertilizer prices has been halted<sup>9</sup>. The explanation for this lies in part in the efforts of the major phosphatic fertilizer producers to shut down surplus capacity while stocks are depleted. Price quotations are \$105 for ammonium phosphates, but the corresponding

prices for superphosphates continue at \$75-\$80. A second factor contributing to the firming of phosphate prices was the stand taken by the major phosphate rock exporters who refused to reduce their contract prices on July 1, 1976.

World potash supply rose nearly 30 percent in 1975-76 while consumption was expected to rise 5 percent. This has been reflected in larger beginning inventories for the 1976-77 year. Increased supplies are expected primarily from North America, the U.S.S.R. and Western Europe. In 1976-77, consumption is expected to be up about 8 percent, but supply only 2 percent. With world potash production being curtailed in 1976-77 to reduce stocks and with the prospect of a strong increase in U.S. potash demand, North American producers are proposing a 5-cents-a-unit (20 pounds) increase in domestic prices<sup>10</sup>. At the same time, substantial discounts are being offered to move potash in the low demand period. North American domestic prices are closely in line now with 1976-77 export prices of \$50-\$55 a tonne. Because of low buyers' stocks at the beginning of the fertilizer year, producers' shipments increased substantially in July and August and their inventories have been significantly reduced. Consequently, potash prices have firmed up.

By 1980-81, projected world supply of the three primary plant nutrients is expected to reach about 127 million tonnes. Consumption by the same year is projected at 120 million tonnes, leaving a positive supply balance of 7 million. The implied growth rate for nitrogen consumption since 1973-74 is about 6 percent, compared with 8 percent for the previous five-year period. The developing countries will likely increase their share of world nitrogen consumption. The implied growth rate for world phosphate consumption is under 4 percent annually, also down from the 6-percent rate of the previous five-year period. Again, the developing countries are expected to increase their share of total world consumption by 1980-81, as well as the centrally-planned economies. The implied growth rate for potash is over 4 percent, down from the 7 percent of the previous period. Consumption is expected to rise most sharply in developing countries and the centrally-planned economy countries are expected to increase their share of world consumption.

## CANADIAN SITUATION

Domestic shipments of fertilizers by Canadian manufacturers declined 5.6 percent in 1975-76, 7 percent in the West and 4 percent in the East. If total consumption

<sup>7</sup> Based in part on Reidinger, *op. cit.* and World Agricultural Situation, ERS/USDA, October 1976, pp. 10-13.

<sup>8</sup> See footnote 5.

<sup>9</sup> See footnote 5.

<sup>10</sup> See footnote 5.

declined this amount, last year's level would be about 2.8 million tons (Table 2). However, this figure does not take into account dealers' and farmers' stocks of fertilizers at the beginning of the year, nor their direct imports. Consequently, when the actual consumption figures are known, the total may have been closer to that of the previous year. Although total product shipments declined, shipments of nitrogenous fertilizers increased slightly over 1 percent. The largest relative decline was in potash shipments.

The apparent decline in consumption was attributable largely to three factors: (1) weakening grain price

prospects; (2) higher fertilizer prices than a year earlier in Western Canada, where the greatest relative growth in consumption has taken place since 1964; and (3) uncertainties in the spring about crop yield prospects with the low soil moisture conditions.

Grain and oilseed prices have been decreasing since their peak in 1973-74 (Figure 1). Prices for the 1975-76 crop year will likely average over 15 percent less than in the previous year and the decline will probably continue into 1976-77, based on price indications at the beginning of the crop year and the current (October, 1976) grain supply situation. Fertilizer prices, while they

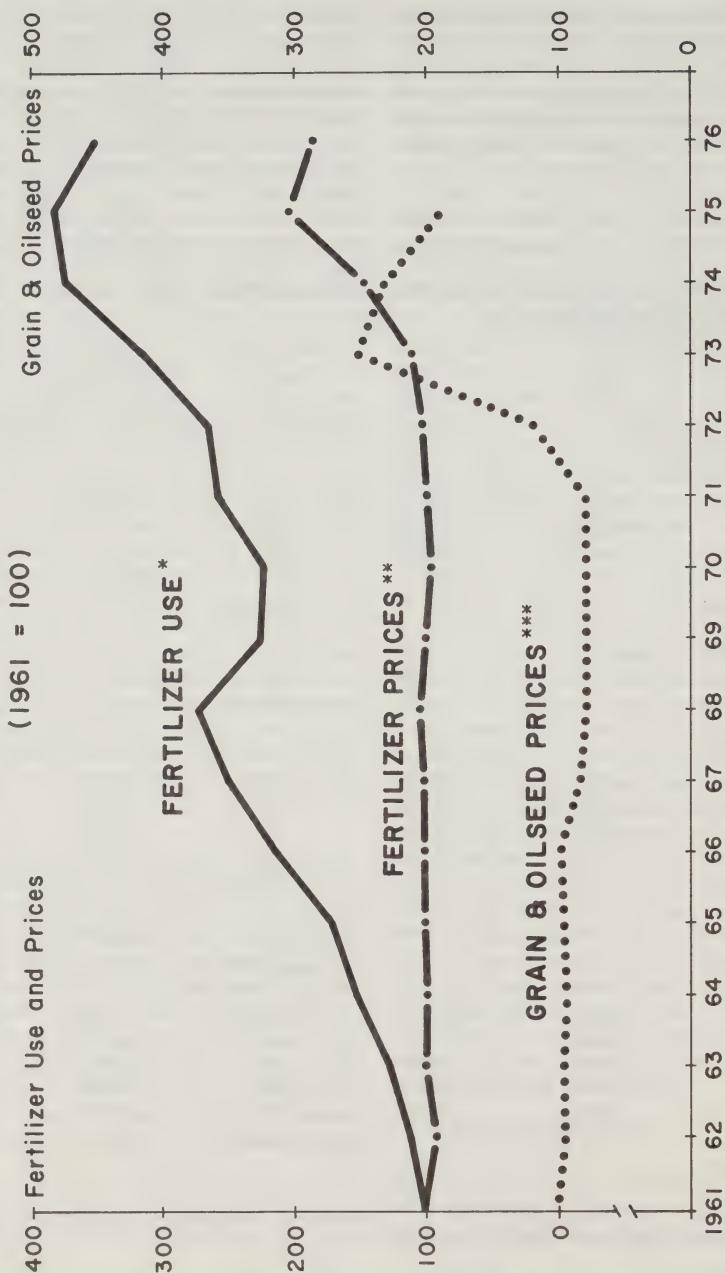
**TABLE 2. CONSUMPTION OF FERTILIZERS (MIXTURES AND MATERIALS) IN CANADA BY REGIONS, 1964 TO 1976 (YEARS ENDING JUNE 30)**

| Region and<br>Period or Year         | Nitrogen<br>(N) | Phosphates<br>(P <sub>2</sub> O <sub>5</sub> ) | Potash<br>(K <sub>2</sub> O) | Total Primary<br>Nutrients<br>(NPK) | Total Product |
|--------------------------------------|-----------------|--|------------------------------|-------------------------------------|---------------|
| — thousand short tons —              |                 |  |                              |                                     |               |
| Eastern Canada                       |                 |  |                              |                                     |               |
| 1964-68                              | 111.9           | 166.0  | 149.4                        | 427.3                               | 1,166.9       |
| 1969-73                              | 175.7           | 200.7  | 190.9                        | 567.3                               | 1,366.5       |
| 1974                                 | 238.9           | 225.3  | 212.8                        | 677.0                               | 1,547.5       |
| 1975                                 | 222.5           | 210.9  | 210.9                        | 644.3                               | 1,501.5       |
| 1976                                 | 221.6           | 201.8  | 164.3                        | 587.7                               | 1,426.4       |
| — percent —                          |                 |  |                              |                                     |               |
| Annual growth rates,<br>1964 to 1976 | 8.6             | 3.2  | 3.6                          | 5.0                                 | 3.0           |
| — thousand short tons —              |                 |  |                              |                                     |               |
| Western Canada                       |                 |  |                              |                                     |               |
| 1964-68                              | 138.7           | 189.5  | 5.3                          | 333.5                               | 721.5         |
| 1969-73                              | 174.1           | 169.4  | 8.8                          | 352.4                               | 742.0         |
| 1974                                 | 326.2           | 319.5  | 9.9                          | 655.6                               | 1,328.0       |
| 1975                                 | 363.1           | 342.2  | 17.1                         | 722.4                               | 1,448.7       |
| 1976                                 | 371.1           | 286.4  | 18.9                         | 676.4                               | 1,341.5       |
| — percent —                          |                 |  |                              |                                     |               |
| Annual growth rates,<br>1964 to 1976 | 12.2            | 6.0  | 13.3                         | 8.9                                 | 8.1           |
| — thousand short tons —              |                 |  |                              |                                     |               |
| All Canada                           |                 |  |                              |                                     |               |
| 1964-68                              | 250.6           | 355.6  | 154.7                        | 760.9                               | 1,888.4       |
| 1969-73                              | 349.8           | 370.1  | 199.8                        | 919.7                               | 2,108.4       |
| 1974                                 | 565.1           | 544.8  | 222.7                        | 1,332.6                             | 2,875.5       |
| 1975                                 | 585.6           | 553.1  | 228.0                        | 1,366.7                             | 2,950.2       |
| 1976                                 | 592.7           | 488.2  | 183.2                        | 1,264.1                             | 2,767.9       |
| — percent —                          |                 |  |                              |                                     |               |
| Annual growth rates,<br>1964 to 1976 | 10.5            | 4.8  | 4.1                          | 6.8                                 | 5.0           |

Source: Statistics Canada, The Fertilizer Trade, Cat. No. 46-207, Annual.

Notes: (1) The 1975-76 estimates given are unofficial and based on the change in manufacturers' shipments. (2) The growth rates are based on logarithmic regressions. (3) Totals may not add due to rounding.

# INDICES OF FERTILIZER USE, FERTILIZER PRICES, GRAIN AND OILSEED PRICES, CANADA, 1961 TO 1976



\* Total Primary Nutrients, Years Ending June 30.

\*\* Spring Prices.

\*\*\* Crop Years Beginning August 1.

Source: Data from Statistics Canada, 1975-76 Estimates Unofficial.

Figure 1

**TABLE 3. INDEXES OF FERTILIZER PRICES, CANADA, SECOND QUARTERS, 1972 TO 1976 (1961=100)**

| Item and Year      | Eastern Canada |                   | Western Canada |                   | All Canada |                   |
|--------------------|----------------|-------------------|----------------|-------------------|------------|-------------------|
|                    | Index          | Percentage Change | Index          | Percentage Change | Index      | Percentage Change |
| <b>Fertilizers</b> |                |                   |                |                   |            |                   |
| 1972               | 103.3          | 0.6               | 111.0          | 9.6               | 105.3      | 2.9               |
| 1973               | 112.2          | 8.6               | 117.5          | 5.9               | 113.6      | 7.9               |
| 1974               | 152.8          | 36.2              | 137.9          | 17.4              | 148.9      | 31.1              |
| 1975               | 213.1          | 39.5              | 192.9          | 39.9              | 207.8      | 39.6              |
| 1976               | 176.0          | -17.4             | 226.7          | 17.5              | 189.3      | -8.9              |
| <b>Materials</b>   |                |                   |                |                   |            |                   |
| 1972               | 98.3           | -0.1              | 111.3          | 10.0              | 107.4      | 7.0               |
| 1973               | 103.1          | 4.9               | 118.3          | 6.3               | 113.7      | 5.9               |
| 1974               | 166.7          | 61.7              | 138.3          | 16.9              | 146.8      | 29.1              |
| 1975               | 234.0          | 40.4              | 194.4          | 40.6              | 206.3      | 40.5              |
| 1976               | 181.7          | -22.4             | 227.4          | 17.0              | 213.7      | 3.6               |
| <b>Mixtures</b>    |                |                   |                |                   |            |                   |
| 1972               | 104.2          | 0.8               | 107.4          | 4.8               | 104.3      | 0.9               |
| 1973               | 113.6          | 9.0               | 109.3          | 1.8               | 113.4      | 8.7               |
| 1974               | 150.5          | 32.5              | 133.9          | 22.5              | 149.9      | 32.2              |
| 1975               | 209.7          | 39.3              | 177.3          | 32.4              | 208.6      | 39.2              |
| 1976               | 175.1          | -16.5             | 219.2          | 23.6              | 176.6      | -15.3             |

Source: Statistics Canada, Farm Input Price Index, Cat. No. 62-004, Quarterly.

declined about 9 percent in 1975-76 (Table 3, Figure 1), were up more than 17 percent in Western Canada. Prices in the East, however, dropped 17 percent. These differing regional changes resulted from the development of a more normal supply-demand balance in North America.

Fertilizer supplies available for Canadian consumption in 1975-76 were generally adequate, although distribution problems developed because of late ordering by buyers. However, farmers in the United States also delayed their orders so the problem was not unique to Canada. At the beginning of the 1976-77 fertilizer year, Canadian manufacturers' stocks of the three primary nutrients were up 54 percent. Potash was up 58 percent, nitrogen 26 percent and phosphates 51 percent.

During the past fertilizer year, there were both regional surpluses and shortages<sup>11</sup>. There was a surplus of ammonia in some areas and a shortage of dry nitrogen in others. Some nitrogen moved into Western Canada from the U.S. Gulf Coast while there was some available in surplus ammonium phosphate products. There was, then, an overall balance in the North American nitrogen supply situation in 1975-76.

<sup>11</sup> E.A. Kowalenko, Marketing the Increased Production From the New Alberta Nitrogen Plants, Address to the Canadian Fertilizer Institute, St. Andrews-by-the-Sea, N.B., August 26, 1976.

## CANADIAN OUTLOOK

### Nitrogen

Twelve producers operate plants at 16 locations for the production of basic nitrogen and phosphatic fertilizer materials. These plants have an estimated annual production capacity for nitrogen in 1976-77 of one and two-third million tons. The only addition to industry capacity in 1976-77 is the plant of Canadian Fertilizers Limited at Medicine Hat, Alberta, having a daily capacity of 1,200 tons of ammonia and 1,500 tons of urea. This plant was built to serve not only the Western Canadian market but also the adjacent market in the United States and, indirectly, part of the Eastern Canadian market<sup>12</sup>. However, another ammonia plant planned by Canadian Fertilizers Limited at Medicine Hat, and one planned by Cominco Limited at Calgary are still under construction and will not be in production for 1976-77. Present production facilities, however, can provide nitrogen products in excess of domestic requirements for 1976-77 and meet the expected needs for a number of years.

The long-term growth in nitrogen fertilizer use by Canadian farmers has averaged 10.5 percent a year since 1963-64, 8.6 percent in the East and 12.2 in the West

<sup>12</sup> See footnote 11.

(Table 2). Continuation of the overall Canadian trend would mean an agricultural demand for nitrogen of just over 1 million tons by 1980–81, well below present domestic capacity.

## Phosphates

No new capacity for phosphatic fertilizer production has been built in Canada for some time. Present capacity is now under 1 million tons annually with the temporary closing of one plant and limited production from another in Eastern Canada. In 1975–76, phosphate rock imports for the manufacture of phosphatic fertilizers declined 15 percent but imports increased about 70 percent. Since North American installed phosphoric acid and phosphate rock production facilities can satisfy projected requirements for the next three to five years<sup>13</sup>, eastern Canadian phosphatic fertilizer requirements will continue to be met both from domestic production and increased U.S. imports. Some U.S. imports are also likely in Western Canada but the quantity will be relatively small.

Consumption of phosphatic fertilizers in Canada has been growing about 5 percent a year since 1963–64, 3 percent in the East compared with 6 percent in the West. In 1975–76, shipments were down sharply in Canada, especially in the West.

Consumption in Canada is expected to expand more rapidly in the West and to grow at a higher rate than for other developed countries<sup>14</sup>. Extending the long-term annual growth rate of just under 5 percent indicates consumption in Canada may reach 700,000 tons by 1980–81. A higher rate of growth is expected in the West than in the East because of the requirements of cereal and oilseed crops for phosphatic fertilizers and because of the projected growth in total cropland area.

## Potash

Canadian potash production capacity in 1976–77 is unchanged from that in 1975–76, at a rated 8.3 million tons of  $K_2O$ , or 13.7 million tons of potassium chloride (KCl) from 10 mines. Current production is about 75 percent of rated capacity, or just over 6 million tons of  $K_2O$ .

The major development in the Canadian potash industry in 1976–77 is the acquisition by the Government of

Saskatchewan of the Duval Corporation of Canada mine near Saskatoon for 128.5 million U.S. dollars. This mine has been in operation since 1968 and has a rated capacity of 1.2 million tons of KCl. Discussions are underway (October, 1976) between the Government of Saskatchewan and the owners of two other mines, Alwinal Potash of Canada Limited and Sylvite of Canada Limited. The rated capacity of these two mines totals 2.2 million tons of KCl.

Growth in potash consumption in Canada since 1963–64 has averaged about 4 percent a year, somewhat below phosphates. In the East, the growth rate has been 3.6 percent a year, but 13.3 percent in the West. However, Western Canadian consumption of potassic fertilizers accounts for less than 10 percent of the total. If the longer-term growth rate since 1963–64 for Canada is maintained, consumption would still be less than 300,000 tons by 1980–81, less than 5 percent of present production.

## 1976–77 Fertilizer Demand and Prices

The Canadian and North American fertilizer supply outlook for 1976–77 as of October 1976, coupled with grain price prospects suggests there will likely be little or no increase in fertilizer prices in 1976–77, with the possible exception of phosphates. Therefore, total fertilizer demand in Canada will probably continue at about the same level as in 1975–76<sup>15</sup>. While overall fertilizer supplies will be adequate, as in the past there could be spot regional shortages of some products. This is particularly likely to occur if too many buyers delay their fertilizer orders until late in the season.

## SUMMARY

In 1975–76 world fertilizer supplies continued to improve and prices to moderate. In 1976–77, however, world fertilizer prices will be firm to higher, especially for potash.

Fertilizer use in Canada in 1975–76, on the basis of manufacturers' shipments to dealers, did not equal the previous year's level. Final consumption figures will likely show little change from the 1974–75 level.

<sup>15</sup> Based on the predicting equation:

$$F_t = 312.6 - 4.21 P_t^f + 3.27 P_{t-1}^g + .95 F_{t-1}$$

where:  $F_t$  = total fertilizer product demand in year  $t$ ,

$P_t^f$  = fertilizer price index in the spring of year  $t$ , and

$P_{t-1}^g$  = grain and oilseed price index in crop year  $t-1$ .

<sup>13</sup> W.J. Turbeville, Jr., The Phosphate Situation, Address to the Canadian Fertilizer Institute, St. Andrews-by-the-Sea, N.B., August 26, 1976.

<sup>14</sup> See footnote 13.

Several factors contributed to this situation: (1) an increase of over 17 percent in Western Canadian fertilizer prices (Eastern Canadian prices fell 17 percent); (2) a continued weakening of grain prices; and (3) uncertain crop yield prospects at planting time.

Fertilizer supplies for domestic use in 1976–77 will be adequate. The new ammonia plant of Canadian Fertilizers Limited at Medicine Hat, Alberta, will mean increased nitrogen supplies in Western Canada and, indirectly, in Eastern Canada. Phosphatic fertilizer requirements will be met both from domestic production and increased U.S. imports. Domestic fertilizer prices seem likely to hold close to current levels (October, 1976). With current grain price prospects, no increase in fertilizer demand is foreseen, assuming no change in fertilizer prices in the spring of 1977.

## APPENDIX

### The Canadian Fertilizer Industry: A General Description

The Canadian industry is composed of two distinctive groups of producers, an eastern and a western group. Both compete with U.S. fertilizer producers for a share of the North American market in a north-south trading pattern. This pattern has developed over the years since transportation costs for fertilizers are a very significant factor in the overall production costs.

#### Production Facilities

The western Canadian industry consists of production facilities having the following capacities per year:

1. eight nitrogen plants with a total capacity as N of 980,000 tons;
2. seven phosphate plants with a total productive capacity as  $P_2O_5$  of 680,000 tons; and
3. ten potash mines and related refineries with a total productive capacity as  $K_2O$  of 8.3 million tons.

The eastern Canadian segment (Ontario east) of the industry is composed of the following production facilities:

1. four nitrogen plants with a total productive capacity as N of 650,000 tons; and
2. five phosphate plants with a total productive capacity as  $P_2O_5$  of 420,000 tons.

Most of the basic fertilizer production facilities have been built to world-scale capacity to derive the necessary

economies of large-scale production. These conditions are evident by the fact that close to 80 percent of the total production of nitrogen, phosphate and potash fertilizers manufactured in Canada are exported to markets around the world.

#### Distribution

The industry markets through an extensive retail distribution system which must be able to handle 2 million tons of product over a six to eight week period. The eastern retail distribution system is much more extensive than on the Prairies, as most fertilizers sold to eastern farmers are in the form of blends consisting of nitrogen, phosphorus, and potassium. These fertilizers are physically mixed by small blending plants located close to the consumer and often are prepared according to the individual's requirements based on soil tests. The fertilizer ingredients most frequently blended in the East are ammonium nitrate, urea, diammonium phosphate, superphosphates, and muriate of potash. Prior to the introduction of bulk blending facilities in the early 1960s, fertilizers were produced mainly by a few large, centrally-located granulating plants which, by means of chemical reaction, combined the nitrogen, phosphorus and potash materials to form mixed fertilizers. Due to the lack of flexibility in producing the numerous different formulations of fertilizers demanded by farmers, and the generally higher costs of production and transportation for granulation plants, most of these plants have been replaced by bulk blending facilities in recent years.

In Western Canada, with the exception of some of the coastal areas of British Columbia, residual soil levels of potash are generally more than adequate to meet cropping needs. Furthermore, since the predominant crops grown on the Prairies are cereals, which do not require nitrogen to the same extent as eastern crops (e.g., corn, which is grown extensively in eastern Canada), blended fertilizers are seldom offered to or required by Prairie farmers. The western Canadian fertilizer requirements are usually met, therefore, by applying directly to the soil actual fertilizer chemicals, i.e., urea, ammonium nitrate and ammonium phosphates. The western Canadian industry, as a result, retails products through a large number of warehouses located throughout the Prairies, having both storage facilities for bulk and bagged products.

The industry usually provides at the retail level such technical services as soil analyses and related agronomic recommendations for fertilizer use. Also, the industry provides such customer services as custom application of fertilizers and rental of fertilizer application equipment,

i.e., anhydrous ammonia applicators and bulk fertilizer spreaders.

### **Raw Materials for Fertilizer Production**

The raw materials for fertilizers generally come from mines or the atmosphere. Although by-products from the steel industry and waste from food-producing operations were major sources in the past, they have become less important with the development of efficient manufacturing processes for commercial fertilizers. In the case of nitrogen, hydro-carbons (natural gas being the source used in Canada) are a source of hydrogen energy which is used in the nitrogen fixation process. For example, 40,000 cubic feet of natural gas is required to produce 1 ton of ammonia, which is equivalent to about one quarter of the natural gas required to heat the average Canadian home for one year. The nitrogen produced is in the form of anhydrous ammonia which may be applied directly or used to build other fertilizer materials. Coal, another hydro-carbon, may also be used to produce nitrogen fertilizers; however, the cost of change-over and the per-unit cost thereafter is much

higher for plants based on coal for their energy and hydrogen requirements.

The source of phosphorus in fertilizers is phosphate rock, a natural deposit of calcium phosphate ore. Since Canadian deposits of phosphates are generally of a very low grade and quality and difficult to mine efficiently, all of our phosphate rock is imported primarily from U.S. sources. Canadian phosphate fertilizer manufacturers process the phosphate rock into a form suitable for plant nutrition by treating it with the following acids: sulphuric (a by-product from the metal and petroleum industries), and phosphoric or nitric acid.

Potassium supplies are obtained from sub-surface bedded potash deposits in Saskatchewan. In contrast to phosphate rock, potash ores can be used directly in the form of potassium chloride, which is often referred to as muriate of potash, without extensive chemical conversion. Unfortunately, the potash deposits are deeply covered by rock and soil and thus the two major problems are mining from depths up to 6,000 feet and then separating the unwanted compounds from the ore.

# FARM FINANCE



R.S. Rust\*

*The total amount of farm credit extended in 1977 may fall below the 1976 level unless farm income prospects for grains and livestock improve early in the year. Short-term credit is likely to be the only one to show an increase. Interest rates will continue relatively high and though the prime lending rate of chartered banks dropped by one half of one percent in late 1976, further decreases in 1977 will be very slight, if they do occur.*

## SITUATION

In 1974 and 1975, there were very large increases in the amount of credit extended, caused mainly by attractive grain prices and expectations of continued high rates of inflation. The amount extended in 1976 is believed to have been slightly less than in 1975 because of expectations for lower grain prices, a decrease in supply of credit from some sources, anticipation of lower inflation rates and fewer farms being available for purchase at prices that reflect the changed agricultural outlook.

## FARM CREDIT, 1964-73

During the 1964-68 period, farm credit extended increased about 33 percent, from \$1,642 million to \$2,177 million (Table 1). The increase would have been much greater had it not been for the 1968 decrease in long-term and especially intermediate-term credit in Western Canada. In the same period, credit outstanding increased 57 percent, from \$2,613 million to \$4,105 million. Long-term debt increased 90 percent, intermediate-term 30 percent and short-term 50 percent. Credit extended during the period ranged from 8.6 percent of total farm investment in 1968 to 9.7 percent in 1965 and 1967. Farm debt, on the other hand, ranged from 14.9 percent of total farm investment in 1964 to 16.9 percent in 1967 (Table 2).

During the next five-year period, credit extended increased about 65 percent from \$2,169 million in 1969 to \$3,583 million in 1973 (Table 1). Credit extended ranged from 8.3 percent of total farm investment in 1969 to 10.9 percent in 1973. Farm debt increased from \$4,425 million in 1969 to \$5,085 million in 1972, and then to \$5,871 million in 1973, a period increase of 33 percent. As a percent of total farm investment, credit outstanding ranged from 16.9 percent in 1969 and 1970 to 18.2 percent in 1972 (Table 2).

## FARM CREDIT, 1974-76

### Credit Extended

Based on revised estimates for 1974 and preliminary estimates for 1975, credit extended increased 18 percent in 1974, from \$3,583 million to \$4,227 million, and 28 percent in 1975, to \$5,413 million. Much of the abnormal increase in 1975 resulted from farmers expecting that, due to the rate of inflation and attractive grain prices, they could greatly profit by the purchase of additional land, machinery and equipment. It is estimated that in 1976, credit extended may have decreased 3 percent, to \$5,246 million. However, this estimate is based on a limited amount of data. Bank credit increased substantially early in 1976, but loans from federal sources decreased sharply. Other credit sources indicated that both increases and decreases were expected. It is not known whether the decrease in federal financing in 1976 caused a substantial increase in financing by private individuals. If it has, the total

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**TABLE 1. AMOUNT OF FARM CREDIT EXTENDED AND OUTSTANDING, TOTALS AND SUBTOTALS BY LENGTH OF TERM AND PERCENT CHANGE BY PERIOD, 1964-68, 1969-73**

| Year                    | Total extended | Long-term | Intermediate-term | Short-term | Total outstanding | Long-term | Intermediate-term | Short-term |
|-------------------------|----------------|-----------|-------------------|------------|-------------------|-----------|-------------------|------------|
| — millions of dollars — |                |           |                   |            |                   |           |                   |            |
| 1964                    | 1,641.7        | 224.4     | 354.3             | 1,063.0    | 2,613.3           | 902.7     | 882.8             | 827.8      |
| 1965                    | 1,862.8        | 292.6     | 435.7             | 1,134.5    | 3,004.4           | 1,098.8   | 1,029.0           | 885.6      |
| 1966                    | 2,021.7        | 344.2     | 476.4             | 1,201.1    | 3,444.2           | 1,327.5   | 1,147.7           | 946.9      |
| 1967                    | 2,270.0        | 378.5     | 503.1             | 1,388.4    | 3,950.7           | 1,560.1   | 1,300.8           | 1,039.8    |
| 1968                    | 2,177.2        | 316.8     | 311.9             | 1,548.5    | 4,104.8           | 1,713.4   | 1,147.7           | 1,243.7    |
| — percent change —      |                |           |                   |            |                   |           |                   |            |
| 1964-68                 | 32.6           | 41.2      | -12.0             | 45.7       | 57.1              | 89.8      | 30.0              | 50.2       |
| — millions of dollars — |                |           |                   |            |                   |           |                   |            |
| 1969                    | 2,168.9        | 245.7     | 415.5             | 1,507.7    | 4,424.8           | 1,796.2   | 1,210.9           | 1,417.7    |
| 1970                    | 2,239.5        | 196.8     | 420.2             | 1,622.5    | 4,480.7           | 1,854.3   | 1,179.7           | 1,446.7    |
| 1971                    | 2,640.7        | 206.0     | 528.4             | 1,906.3    | 4,714.3           | 1,875.9   | 1,249.5           | 1,588.9    |
| 1972                    | 2,975.8        | 231.9     | 701.3             | 2,042.6    | 5,085.2           | 1,917.6   | 1,431.7           | 1,735.9    |
| 1973                    | 3,582.7        | 461.8     | 848.6             | 2,272.3    | 5,871.4           | 2,132.4   | 1,929.3           | 1,809.7    |
| — percent change —      |                |           |                   |            |                   |           |                   |            |
| 1969-73                 | 65.2           | 88.0      | 104.2             | 50.7       | 32.7              | 18.7      | 59.3              | 27.7       |

**TABLE 2. THE RATIO OF FARM CREDIT EXTENDED AND FARM DEBT TO FARM INVESTMENT, CANADA, 1964-75**

| Year                    | Investment in farm real estate, machinery and livestock <sup>a</sup> | Estimated total investment of farmers <sup>b</sup> | Farm credit extended | Farm debt | Farm debt as a percent of farm real estate, machinery and livestock investment | Farm debt as a percent of total farm investment | Credit extended as a percent of total investment |
|-------------------------|--|--|----------------------|-----------|--|---|--|
| — millions of dollars — |  |  |                      |           | — percent —  |   |  |
| 1964                    | 15,744.1   | 17,493.4   | 1,641.7              | 2,613.3   | 16.6   | 14.9  | 9.4  |
| 1965                    | 17,217.8   | 19,130.9   | 1,862.8              | 3,004.4   | 17.4   | 15.7  | 9.7  |
| 1966                    | 19,062.7   | 21,180.8   | 2,021.7              | 3,444.2   | 18.1   | 16.3  | 9.5  |
| 1967                    | 21,069.2   | 23,410.2   | 2,270.0              | 3,950.7   | 18.8   | 16.9  | 9.7  |
| 1968                    | 22,700.5   | 25,222.8   | 2,177.2              | 4,104.8   | 18.1   | 16.3  | 8.6  |
| 1969                    | 23,507.5   | 26,119.4   | 2,168.9              | 4,424.8   | 18.8   | 16.9  | 8.3  |
| 1970                    | 23,801.0   | 26,445.6   | 2,239.5              | 4,480.7   | 18.8   | 16.9  | 8.5  |
| 1971                    | 23,886.4   | 26,540.4   | 2,640.7              | 4,714.3   | 19.7   | 17.8  | 9.9  |
| 1972                    | 25,177.8   | 27,975.3   | 2,975.8              | 5,085.2   | 20.2   | 18.2  | 10.6   |
| 1973                    | 29,522.2   | 32,802.4   | 3,582.7              | 5,871.4   | 19.9   | 17.9  | 10.9   |
| 1974                    | 36,081.0   | 40,090.0   | 4,227.4              | 6,888.9   | 19.1   | 17.2  | 10.5   |
| 1975                    | 42,531.0   | 47,256.7   | 5,413.4              | 8,118.9   | 19.1   | 17.2  | 11.1   |

<sup>a</sup>Source: Quarterly Bulletin of Agricultural Statistics, Cat. No. 21-003, Statistics Canada (excludes Newfoundland, Yukon and Northwest Territories).

<sup>b</sup>Ninety percent of total investment is estimated to be in farm real estate, machinery and livestock and 10 percent in other investments.

amount of credit extended in 1976 may have continued to increase but at a much slower rate than in recent years.

In 1974, out of a total of \$4,227 million in credit extended, \$636 million was long-term, \$992 million

intermediate-term and \$2,600 million short-term credit. In 1975, \$654 million was long-term, \$1,199 million intermediate-term and \$3,560 million short-term (Table 3). In 1976, estimates indicate \$421 million to be long-term, \$1,262 million intermediate-term and \$3,562 million short-term credit.

TABLE 3. ESTIMATED FARM CREDIT EXTENDED, CANADA, 1972-75

| Source and term of credit                    | Estimated farm credit extended |                   |                   |                   | Estimated average interest rate |                   |                   | Percent of credit extended by source |                   |
|--|--------------------------------|-------------------|-------------------|-------------------|---------------------------------|-------------------|-------------------|--------------------------------------|-------------------|
|  | 1972                           | 1973 <sup>a</sup> | 1974 <sup>a</sup> | 1975 <sup>b</sup> | 1973 <sup>a</sup>               | 1974 <sup>a</sup> | 1975 <sup>b</sup> | 1974 <sup>a</sup>                    | 1975 <sup>b</sup> |
|  | — millions of dollars —        |                   |                   |                   | — percent —                     |                   |                   | — percent —                          |                   |
| LONG-TERM (10 years and over)                |                                |                   |                   |                   |                                 |                   |                   |                                      |                   |
| Farm Credit Corporation                      | 156.0                          | 333.2             | 430.9             | 472.0             | 6.8                             | 7.9               | 8.2               | 10.2                                 | 8.7               |
| Veterans' Land Act                           | 11.4                           | 12.4              | 11.7              | 6.7               | 6.7                             | 7.3               | 8.2               | 0.3                                  | 0.1               |
| Provincial Government agencies               | 36.9                           | 91.2              | 163.7             | 128.3             | 6.2                             | 5.6               | 6.2               | 3.9                                  | 2.4               |
| Private individuals                          | 17.0                           | 19.0              | 22.0              | 40.0              | 7.5                             | 8.5               | 9.0               | 0.5                                  | 0.7               |
| Insurance, trust and loan companies          | 5.0                            | 4.0               | 4.0               | 3.0               | 13.0                            | 13.5              | 12.5              | 0.1                                  | 0.1               |
| Treasury Branches (Alberta)                  | 3.7                            | —                 | —                 | —                 | —                               | —                 | —                 | —                                    | —                 |
| Alberta Electrical Co-operatives             | 1.9                            | 2.0               | 3.5               | 4.4               | 3.5                             | 3.5               | 3.5               | 0.0                                  | 0.1               |
| Total long-term                              | 231.9                          | 461.8             | 635.8             | 654.4             | 6.7                             | 7.3               | 7.8               | 15.0                                 | 12.1              |
| INTERMEDIATE-TERM<br>(18 months to 10 years) |                                |                   |                   |                   |                                 |                   |                   |                                      |                   |
| Banks (FILA)                                 | 177.9                          | 223.8             | 162.9             | 188.9             | 6.5                             | 9.1               | 8.5               | 3.9                                  | 3.5               |
| Banks (other than FILA)                      | 65.0                           | 129.0             | 197.0             | 212.0             | 11.5                            | 11.8              | 11.2              | 4.7                                  | 3.9               |
| Private individuals                          | 151.0                          | 174.0             | 257.0             | 304.0             | 9.5                             | 9.5               | 9.1               | 6.1                                  | 5.6               |
| Supply companies                             | 144.3                          | 125.4             | 164.0             | 261.0             | 14.9                            | 15.5              | 15.2              | 3.9                                  | 4.8               |
| FCC (farm syndicate loans)                   | 1.9                            | 4.4               | 5.3               | 4.5               | 6.3                             | 8.5               | 8.2               | 0.1                                  | 0.1               |
| Insurance, trust and loan companies          | 27.0                           | 20.0              | 18.0              | 16.0              | 12.5                            | 13.5              | 12.0              | 0.4                                  | 0.3               |
| Federal Business Development Bank            | 16.5                           | 22.7              | 38.8              | 28.4              | 9.7                             | 12.5              | 12.0              | 0.9                                  | 0.5               |
| Provincial Government agencies               | —                              | 1.0               | 1.5               | 0.6               | 8.0                             | 8.5               | 9.1               | 0.0                                  | 0.0               |
| Credit unions including FILA <sup>c</sup>    | 90.1                           | 98.3              | 99.7              | 142.0             | 9.9                             | 11.8              | 11.3              | 2.4                                  | 2.6               |
| Municipalities (Ontario Tile Drainage)       | 4.7                            | 8.0               | 12.5              | 16.2              | 4.0                             | 4.0               | 4.0               | 0.3                                  | 0.3               |
| Finance companies (cars and trucks)          | 16.0                           | 12.0              | 18.0              | 15.0              | 13.0                            | 13.5              | 14.5              | 0.4                                  | 0.3               |
| Treasury Branches (Alberta) <sup>d</sup>     | 6.9                            | 30.0              | 17.0              | 10.5              | 11.0                            | 11.4              | 11.1              | 0.4                                  | 0.2               |
| Total intermediate-term                      | 701.3                          | 848.6             | 991.7             | 1,199.1           | 10.0                            | 11.3              | 11.1              | 23.5                                 | 22.1              |
| SHORT-TERM (Up to 18 months)                 |                                |                   |                   |                   |                                 |                   |                   |                                      |                   |
| Banks (other than FILA)                      | 1,404.0                        | 1,618.7           | 1,805.0           | 2,669.9           | 10.8                            | 11.8              | 11.0              | 42.7                                 | 49.2              |
| Supply companies                             | 269.2                          | 216.0             | 264.0             | 280.0             | 15.0                            | 15.5              | 14.5              | 6.2                                  | 5.2               |
| Credit Unions                                | 163.6                          | 211.5             | 242.5             | 287.9             | 10.7                            | 12.0              | 12.3              | 5.8                                  | 5.3               |
| Finance companies (household & personal)     | 14.0                           | 16.0              | 17.0              | 15.0              | 19.0                            | 18.0              | 18.0              | 0.4                                  | 0.3               |
| Dealers, stores, etc.                        | 10.0                           | 12.0              | 16.0              | 10.0              | 15.0                            | 14.0              | 13.0              | 0.4                                  | 0.2               |
| Private individuals                          | 104.0                          | 114.0             | 138.0             | 167.0             | 8.5                             | 9.5               | 9.2               | 3.3                                  | 3.1               |
| Treasury Branches (Alberta) <sup>e</sup>     | 27.4                           | 39.6              | 65.4              | 73.5              | 10.4                            | 11.3              | 10.6              | 1.5                                  | 1.4               |
| Provincial agencies                          | 1.3                            | 0.5               | 1.8               | 2.8               | 9.3                             | 10.0              | 11.0              | 0.0                                  | 0.0               |
| Co-operative programs                        | 49.1                           | 44.0              | 50.2              | 54.7              | 9.0                             | 9.0               | 8.3               | 1.2                                  | 1.0               |
| Total short-term                             | 2,042.6                        | 2,272.3           | 2,599.9           | 3,559.9           | 11.1                            | 11.1              | 11.4              | 61.5                                 | 65.8              |
| Total all credit                             | 2,975.8                        | 3,582.7           | 4,227.4           | 5,413.4           | 10.3                            | 11.2              | 10.9              | 100.0                                | 100.0             |

<sup>a</sup>Revised<sup>b</sup>Preliminary<sup>c</sup>FILA 8.5 million in 1975<sup>d</sup>FILA 5.4 million in 1975<sup>e</sup>Short-term data are for a period up to five years

The Farm Credit Corporation provided \$472 million in long-term credit in 1975, but up to September, 1976 had disbursed only \$178 million. While the total credit extended by the Corporation represented only 8.8 percent of total credit extended in 1975, it provided 72 percent of the total long-term credit. The total amount extended by federal sources represented 9.4 percent of total credit extended, and when combined with credit

from provincial sources represented 12.1 percent, down from 15.7 percent in 1974. The proportion of the total credit supplied by banks increased from 51 percent in 1974 to nearly 57 percent in 1975, with much of the intermediate-term bank credit being under federal or provincial guarantee. Supply companies, private individuals and credit unions in 1975 supplied 10, 9.4 and 7.9 percent, respectively, of all credit provided.

Whether increases in land prices have a significant effect on the total credit extended in any given year depends not only on the availability of farm savings and the supply of credit, but on the demand for land for agricultural and non-agricultural uses and the supply of productive land for sale. Many owners of productive land who contemplated selling their farms during recent years appear to have delayed making sales due to yearly land price increases. The permanent holding of land by absentee landowners and family transfer of such assets may also be affecting the supply of purchasable land. Land prices increased 18 percent in 1974, 24 percent in 1975 and preliminary August reports for Ontario and Quebec indicate that a further national increase of about 15 percent may have occurred in 1976. With the sharp drop in wheat prices in 1976, demand for land, particularly in the Prairie Provinces, appears to have decreased.

### Credit Outstanding

Revised estimates for 1974 indicate that \$6,889 million was outstanding on farm accounts, of which \$2,463 million was long-term debt, \$2,356 million intermediate-term and \$2,070 million short-term (Table 4). This represented a 17.3-percent increase in debt over that of the previous year. In 1975 preliminary estimates of total farm debt indicate \$8,119 million was outstanding, of which \$2,754 million was long-term, \$2,733 million intermediate-term and \$2,632 million short-term debt (Table 4). The total debt in 1975 was 17.8 percent greater than in 1974 but the percent of debt by length of term was nearly equal. In 1975, farmers owed banks \$2,718 million; however, \$820 million, or 33 percent was covered by federal or provincial guarantees. The indebtedness of farmers to federal sources of credit that year represented over 26 percent of their total debt, and nearly 34 percent when combined with credit from all provincial sources. Indebtedness to private individuals, credit unions and supply companies represented 13, 9 and 7 percent, respectively, of the total farm debt. Total farm debt for 1976 is estimated to be \$8,847 million, of which \$2,871 million is expected to be long-term, \$2,929 million intermediate-term and \$3,047 million short-term debt. Debt estimates for 1976 are all subject to major revisions.

Loans to farmers by banks are heavily concentrated in three provinces. Of \$2,649 million outstanding on the farm accounts of banks as of March 1976, the debt of farmers in Ontario was 29 percent of this, in Alberta 28 percent and in Saskatchewan 19. Farm debt for Manitoba, British Columbia and Quebec was about 10, 7 and 5 percent, respectively (Table 5).

### Relationships of Credit Extended and Farm Debt to Total Farm Investment, 1974-75

Farm credit extended depends largely on the value of total farm investment, and also on the prospects of profit. The consistency of the relationship and the effect of the lack of demand for grain in the 1968-70 period are indicated indirectly in Table 2. In 1975, credit extended equalled 11.1 percent of total farm investment, an increase of .6 of 1 percent over that for the previous year. Total farm investment was estimated at \$40,090 million in 1974 and \$47,257 million in 1975. The ratio of farm debt to total investment was 17.2 percent in 1973 and 18.2 percent in 1972. In 1969, the ratio was 8.3 percent, the low point for the 1964-75 period. The relationships between farm debt, credit extended and total farm investment are shown in Figure 1.

### INTEREST RATES, 1974-76

The estimated average interest rate charged on total farm credit extended was 11.2 percent in 1974 and 10.9 in 1975. By length of term the weighted averages were: 7.3 and 7.8 percent on long-term; 11.3 and 11.1 on intermediate-term and 11.1 and 11.4 on short-term, respectively, for 1974 and 1975 (Table 3). On credit outstanding the estimated average interest rates were 8.8 percent in 1974 and 9.2 in 1975. By length of term the average rates were: 5.7 and 6.2 percent on long-term; 9.8 and 10 on intermediate-term and 11.4 and 11.6 on short-term, respectively, for these two years. Total estimated interest charges on farm credit outstanding for 1974 and 1975 are estimated at \$608 million and \$750 million, respectively (Table 4). It is estimated that in 1976 interest rates may have increased .5 of 1 percent on credit extended and .7 of 1 percent on credit outstanding.

Prime interest rates of banks ranged from 9.5 to 11.5 percent in 1974 and from 9 to 10.5 percent in 1975. In 1976, the prime rate varied from 9.75 percent in January to 10.25 in October (Table 6). From April 1, 1976 to September 30, the interest rate on loans under the Farm Credit Act (FCA) and on real-estate loans under the Farm Improvement Loans Act (FILA) was 9.75 percent while the rate on loans under the Farm Syndicates Credit Act and on non-real estate loans under FILA was 9.5 percent. On October 1, 1976 the 9.75-percent rate was increased to 10 percent, but the 9.5-percent rate was not changed. These rates will apply until April 1, 1977.

### OUTLOOK

The decreased world demand for wheat, sharply reduced wheat prices, the expected carry-over of 500 million

TABLE 4. ESTIMATED FARM CREDIT OUTSTANDING 1972-75, INTEREST RATES, INTEREST CHARGES AND DISTRIBUTION OF DEBT BY SOURCE

| Source and term of credit                    | Estimated farm credit outstanding |                   |                   |                   | Estimated average interest rate |                   |                   | Estimated Total interest charges |                   |                   | Percent outstanding by source |                   |
|--|-----------------------------------|-------------------|-------------------|-------------------|---------------------------------|-------------------|-------------------|----------------------------------|-------------------|-------------------|-------------------------------|-------------------|
|  | 1972                              | 1973 <sup>a</sup> | 1974 <sup>a</sup> | 1975 <sup>b</sup> | 1973 <sup>a</sup>               | 1974 <sup>a</sup> | 1975 <sup>b</sup> | 1973 <sup>a</sup>                | 1974 <sup>a</sup> | 1975 <sup>b</sup> | 1974 <sup>a</sup>             | 1975 <sup>b</sup> |
|  | — millions of dollars —           |                   |                   |                   | — percent —                     |                   |                   | — millions of dollars —          |                   |                   | — percent —                   |                   |
| LONG-TERM (10 years and over)                |                                   |                   |                   |                   |                                 |                   |                   |                                  |                   |                   |                               |                   |
| Farm Credit Corporation                      | 1,229.1                           | 1,443.7           | 1,684.6           | 1,930.2           | 6.2                             | 6.6               | 7.0               | 79.54                            | 97.65             | 121.69            | 24.5                          | 23.8              |
| Veterans' Land Act                           | 147.2                             | 142.0             | 133.8             | 105.4             | 6.1                             | 6.4               | 7.5               | 8.66                             | 8.56              | 7.91              | 1.9                           | 1.3               |
| Provincial Government agencies               | 404.6                             | 415.5             | 517.3             | 563.6             | 4.7                             | 4.9               | 5.1               | 19.53                            | 25.35             | 28.74             | 7.5                           | 6.9               |
| Private individuals                          | 72.0                              | 83.0              | 84.0              | 114.0             | 6.3                             | 6.7               | 7.0               | 5.63                             | 5.63              | 7.98              | 1.2                           | 1.4               |
| Insurance, trust & loan companies            | 46.0                              | 35.0              | 29.0              | 24.0              | 10.1                            | 10.4              | 10.8              | 3.54                             | 3.02              | 2.59              | 0.4                           | 0.3               |
| Treasury Branches (Alberta)                  | 5.0                               | —                 | —                 | —                 | —                               | —                 | —                 | —                                | —                 | —                 | —                             | —                 |
| Alberta Electrical Co-operatives             | 13.7                              | 13.2              | 14.6              | 16.7              | 3.5                             | 3.5               | 3.5               | 0.46                             | 0.51              | 0.58              | 0.2                           | 0.5               |
| Total long-term                              | 1,917.6                           | 2,132.4           | 2,463.3           | 2,753.9           | 5.5                             | 5.7               | 6.2               | 116.96                           | 140.72            | 169.49            | 35.7                          | 33.7              |
| INTERMEDIATE-TERM<br>(18 months to 10 years) |                                   |                   |                   |                   |                                 |                   |                   |                                  |                   |                   |                               |                   |
| Banks (FILA) <sup>c</sup>                    | 374.0                             | 446.1             | 447.0             | 470.0             | 7.2                             | 8.0               | 8.7               | 32.12                            | 35.76             | 40.89             | 6.5                           | 5.8               |
| Banks (other than FILA)                      | 80.0                              | 263.0             | 404.0             | 437.0             | 10.6                            | 11.3              | 11.0              | 27.88                            | 45.65             | 48.07             | 5.8                           | 5.4               |
| Private individuals                          | 547.0                             | 629.0             | 850.0             | 850.0             | 6.9                             | 8.0               | 7.5               | 43.40                            | 55.20             | 63.75             | 10.0                          | 10.5              |
| Supply companies                             | 185.2                             | 145.7             | 220.0             | 362.0             | 14.9                            | 15.2              | 15.3              | 21.71                            | 33.44             | 55.39             | 3.2                           | 4.4               |
| FCC (farm syndicate loans)                   | 6.7                               | 7.8               | 11.1              | 12.3              | 6.9                             | 7.3               | 7.5               | 0.67                             | 0.47              | 0.87              | 0.2                           | 0.2               |
| Insurance, trust & loan companies            | 32.7                              | 51.0              | 49.0              | 48.0              | 11.2                            | 13.0              | 12.0              | 5.72                             | 6.37              | 5.76              | 0.7                           | 0.6               |
| Federal Business Development Bank            | 42.0                              | 50.0              | 70.0              | 84.0              | 9.4                             | 10.6              | 11.0              | 4.70                             | 7.42              | 9.24              | 1.0                           | 1.0               |
| Provincial Government agencies               | —                                 | 5.0               | 5.8               | 6.1               | 7.0                             | 8.0               | 7.8               | 0.35                             | 0.46              | 0.47              | 0.1                           | 0.1               |
| Credit unions including FILA                 | 110.0                             | 251.6             | 355.4             | 347.9             | 9.9                             | 10.6              | 11.3              | 24.91                            | 37.67             | 39.31             | 5.2                           | 4.3               |
| Municipalities (Ontario Tile Drainage)       | 24.4                              | 29.2              | 37.6              | 48.9              | 4.0                             | 4.0               | 4.0               | 1.17                             | 1.51              | 1.96              | 0.5                           | 0.6               |
| Finance companies (cars and trucks)          | 23.0                              | 18.0              | 25.0              | 24.0              | 13.2                            | 13.4              | 14.2              | 2.38                             | 3.35              | 3.41              | 0.4                           | 0.3               |
| Treasury Branches (includes FILA)            | 6.7                               | 32.8              | 40.6              | 43.2              | 10.6                            | 10.7              | 11.1              | 3.48                             | 4.35              | 4.80              | 0.6                           | 0.5               |
| Total intermediate-term                      | 1,431.7                           | 1,929.3           | 2,355.5           | 2,733.4           | 8.7                             | 9.8               | 10.0              | 168.39                           | 231.65            | 273.92            | 34.2                          | 33.7              |
| SHORT-TERM (up to 18 months)                 |                                   |                   |                   |                   |                                 |                   |                   |                                  |                   |                   |                               |                   |
| Banks (other than FILA)                      | 1,116.0                           | 1,294.0           | 1,444.0           | 1,811.0           | 10.5                            | 11.0              | 11.3              | 135.87                           | 158.84            | 204.64            | 21.0                          | 22.3              |
| Supply companies                             | 185.2                             | 137.0             | 189.0             | 200.0             | 14.0                            | 15.5              | 15.5              | 19.18                            | 29.30             | 31.00             | 2.8                           | 2.4               |
| Credit unions                                | 259.0                             | 189.3             | 218.4             | 373.9             | 10.7                            | 11.7              | 12.2              | 20.25                            | 25.55             | 45.62             | 3.2                           | 4.6               |
| Finance companies (household & personal)     | 12.0                              | 8.0               | 7.0               | 5.0               | 19.0                            | 18.0              | 18.0              | 1.52                             | 1.26              | 0.90              | 0.1                           | 0.1               |
| Dealers, stores, etc.                        | 8.5                               | 6.0               | 8.0               | 6.0               | 15.0                            | 15.0              | 14.0              | 0.90                             | 1.20              | 0.84              | 0.1                           | 0.1               |
| Private individuals                          | 86.0                              | 95.0              | 109.0             | 130.0             | 8.0                             | 9.5               | 9.2               | 7.60                             | 10.35             | 11.96             | 1.6                           | 1.6               |
| Treasury Branches (Alberta) <sup>d</sup>     | 28.4                              | 52.7              | 71.4              | 79.4              | 10.0                            | 10.0              | 11.1              | 5.27                             | 7.14              | 8.81              | 1.0                           | 1.0               |
| Provincial Agencies                          | 2.8                               | 0.4               | 1.2               | 1.1               | 9.0                             | 9.0               | 10.8              | 0.04                             | 0.11              | 0.12              | 0.0                           | 0.0               |
| Cooperative programs                         | 30.4                              | 20.0              | 14.2              | 14.9              | 8.5                             | 8.5               | 8.8               | 1.70                             | 1.21              | 1.31              | 0.2                           | 0.2               |
| Unpaid taxes                                 | 7.6                               | 7.0               | 7.9               | 10.3              | 9.9                             | 10.5              | 11.0              | 0.72                             | 0.83              | 1.13              | 0.1                           | 0.1               |
| Total short-term                             | 1,735.9                           | 1,809.7           | 2,070.1           | 2,631.6           | 10.7                            | 11.4              | 11.6              | 193.05                           | 235.79            | 306.33            | 30.1                          | 32.4              |
| Total all credit                             | 5,085.2                           | 5,871.4           | 6,888.9           | 8,118.9           | 8.1                             | 8.8               | 9.2               | 478.40                           | 608.16            | 749.74            | 100.0                         | 100.0             |

<sup>a</sup>Revised<sup>b</sup>Preliminary<sup>c</sup>Total FILA outstanding \$486 million<sup>d</sup>Includes some intermediate-term

TABLE 5. AMOUNT AND PERCENT OF TOTAL OUTSTANDING ON FARM ACCOUNTS OF CHARTERED BANKS<sup>a</sup> BY PROVINCE, DECEMBER, 1973-76

| Province             | Amount<br>Outstanding<br>December<br>1973 | Amount<br>Outstanding<br>December<br>1974 | Amount<br>Outstanding<br>December<br>1975 | Percent by<br>province 1975<br>December 1975 | Amount<br>Outstanding<br>March<br>1975 | Amount<br>Outstanding<br>March<br>1976 | Percent<br>Outstanding<br>March<br>1976 |
|----------------------|---|---|---|--|--|--|---|
|                      | — millions of dollars —                   |   |   | — percent —                                  | — millions of dollars —                |  | percent                                 |
| British Columbia     | 94  | 137                                       | 178                                       | 6.55   | 146                                    | 193                                    | 7.28                                    |
| Alberta              | 563                                       | 669                                       | 753                                       | 27.70  | 629                                    | 740                                    | 27.93                                   |
| Saskatchewan         | 397                                       | 445                                       | 543                                       | 19.98  | 392                                    | 510                                    | 19.25                                   |
| Manitoba             | 179                                       | 195                                       | 255                                       | 9.38   | 189                                    | 252                                    | 9.51                                    |
| Ontario              | 630                                       | 689                                       | 807                                       | 29.70  | 644                                    | 775                                    | 29.26                                   |
| Quebec               | 96  | 106                                       | 119                                       | 4.37   | 106                                    | 122                                    | 4.61                                    |
| New Brunswick        | 15  | 18  | 22  | 0.80   | 17                                     | 19                                     | 0.72                                    |
| Nova Scotia          | 13  | 16  | 19  | 0.70   | 15                                     | 17                                     | 0.64                                    |
| Prince Edward Island | 16  | 19  | 21  | 0.78   | 18                                     | 20                                     | 0.76                                    |
| Newfoundland         | 2   | 1   | 1   | 0.04   | 1                                      | 1                                      | 0.04                                    |
| Total                | 2,005                                     | 2,295                                     | 2,718                                     | 100.00                                       | 2,157                                  | 2,649                                  | 100.00                                  |

<sup>a</sup>Bank of Canada Review (various issues).

bushels by July 1, 1977, the possibility of slightly lower prices for other grains in 1977, and poor prospects in beef and dairy production suggest that there will not likely be any substantial increase in credit extended in

1977 over that in 1976. If long-run expectations for greater income in these fields do not improve early in 1977, the total amount extended will probably be slightly below the preliminary estimate of \$5,246

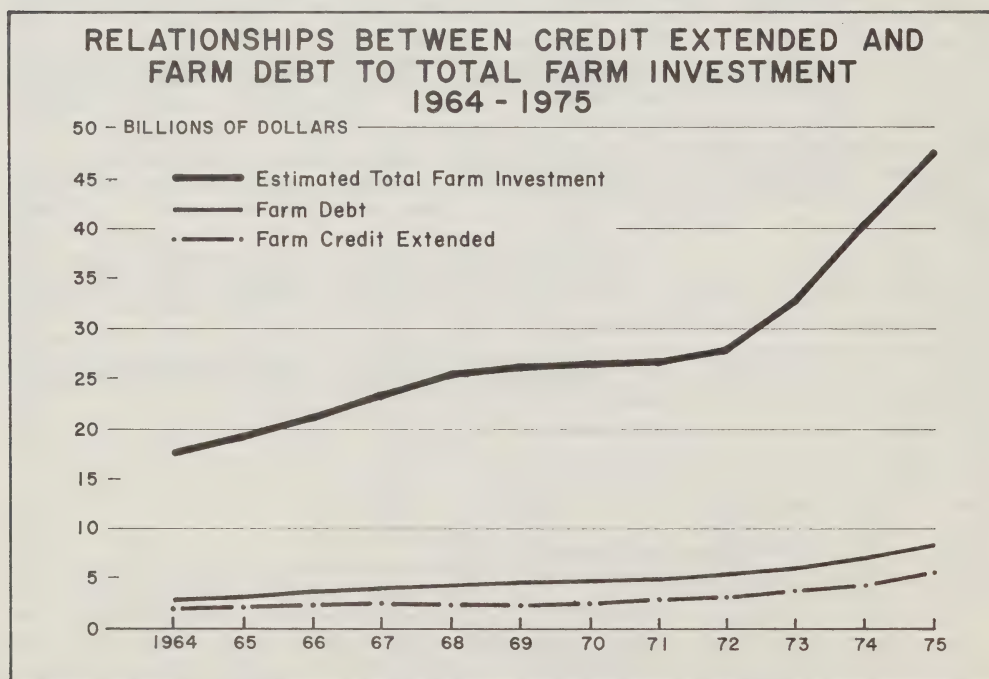


Figure 1

**TABLE 6. CHARTERED BANKS PRIME BUSINESS LOANS RATES (CENTRAL BANK RATES IN BRACKETS) 1971-76**

| Month       | 1971       | 1972       | 1973       | 1974        | 1975            | 1976        |
|-------------|------------|------------|------------|-------------|-----------------|-------------|
| — percent — |            |            |            |             |                 |             |
| January     | 7.00(6.00) | 6.00(4.75) | 6.00(4.75) | 9.50(7.25)  | 10.50(8.25)     | 9.75(9.00)  |
| February    | 7.00(5.25) | 6.00(4.75) | 6.00(4.75) | 9.50(7.25)  | 9.00-9.75(8.25) | 9.75(9.00)  |
| March       | 6.50(5.25) | 6.00(4.75) | 6.00(4.75) | 9.50(7.25)  | 9.00(8.25)      | 10.25(9.50) |
| April       | 6.50(5.25) | 6.00(4.75) | 6.50(5.25) | 10.50(8.25) | 9.00(8.25)      | 10.25(9.50) |
| May         | 6.50(5.25) | 6.00(4.75) | 7.00(5.75) | 11.00(8.75) | 9.00(8.25)      | 10.25(9.50) |
| June        | 6.50(5.25) | 6.00(4.75) | 7.75(6.25) | 11.00(8.75) | 9.00(8.25)      | 10.25(9.50) |
| July        | 6.50(5.25) | 6.00(4.75) | 7.75(6.25) | 11.50(9.25) | 9.00(8.25)      | 10.25(9.50) |
| August      | 6.50(5.25) | 6.00(4.75) | 8.25(6.75) | 11.50(9.25) | 9.00(8.25)      | 10.25(9.50) |
| September   | 6.50(5.25) | 6.00(4.75) | 9.00(7.25) | 11.50(9.25) | 9.75(9.00)      | 10.25(9.50) |
| October     | 6.25(4.75) | 6.00(4.75) | 9.00(7.25) | 11.50(9.25) | 9.75(9.00)      | 10.25(9.50) |
| November    | 6.00(4.75) | 6.00(4.75) | 9.00(7.25) | 11.00(8.75) | 9.75(9.00)      | 9.75(9.00)  |
| December    | 6.00(4.75) | 6.00(4.75) | 9.50(7.25) | 11.00(8.75) | 9.75(9.00)      |             |

Source: Bank of Canada Review (various issues).

million projected for 1976. Loans from federal sources will not likely be substantially greater in 1977 than in 1976. Farm credit extended by banks is expected to decrease slightly in 1977 and the average term of loans made will likely be shorter than in the previous three years. As a consequence, the amount of long-term credit extended in 1977 is expected to remain similar to that in 1976; intermediate-term will likely decrease and short-term should increase. If the total credit extended in 1977 increases it will be nearly entirely due to the magnitude of the expected increase in the amount of short-term credit. In most situations, it is expected that credit officials will give increased attention to the security of loans. Farm debt is expected to increase from 8 to 10 percent in 1977 and the total debt therefore should range from \$9,554 million to \$9,733 million.

Demand for farmland, except for industrial and urban development purposes and purchases by foreign interests, is expected to decrease in 1977. However, an average increase of about 10 percent in land prices in 1977 appears probable. It is expected that the demand

for land will remain relatively strong in Ontario, in parts of Quebec and British Columbia, and decrease in the Prairie Provinces. Increases in land prices in Ontario, Quebec, and British Columbia are expected to be largely due to industrial and urban development demand.

While the data in Table 2 indicate that the credit extended each year is very closely related to total farm investment, what is not shown is the very great variation in the annual increase in the total value of farm real estate, livestock and machinery. This ranged over the 1971-75 period from .4 percent in 1971 to 22.2 percent in 1974. Based on expected smaller increases in the dollar value of total farm investment in the future, the amount of annual credit used by farmers in 1981 should range from \$7,600 million to \$8,900 million.

Interest rates are likely to remain relatively high in 1977. While the prime rate of most banks decreased by one half of one percent late in 1976, further decreases in 1977 are not expected at least before mid-year if at all. If a further decrease does occur late in 1977 it is not expected to exceed .25 of 1 percent.

# ENERGY\*



O.R. Morris\*\*

*The immediate outlook is for a 10-to-15 percent increase in crude oil prices early in 1977, resulting in a 3-cents-per-gallon increase in gasoline, diesel fuel, and heating fuel prices. Electricity costs will continue to increase. There will, however, be sufficient supplies of energy to meet the needs of Canadian agriculture in 1977.*

## INTRODUCTION

For Canadians, three notable developments in the energy situation and outlook have occurred since last October: (1) the adoption of a more open, deliberative approach to policy and price determination within the Organization of Petroleum Exporting Countries (OPEC); (2) the enactment of the United States Energy Policy and Conservation Act of 1975 and (3) in Canada the publishing of *An Energy Strategy For Canada: Policies for Self-Reliance*. These developments have had considerable stabilizing influences on the Canadian situation and outlook for energy.

In short, the energy scene is much more settled than one year ago. This does not imply that serious energy problems are no longer present or that policy decisions are no longer needed. Rather the scene is now one where the scarcity of petroleum and natural gas resources is an accepted fact throughout the world. Policy decisions have been taken by governments to encourage actions — both public and private — that are consistent with the new energy situation and outlook.

## WORLD ENERGY SITUATION AND OUTLOOK

In 1975 world crude oil production decreased to 53.2 million barrels per day (bb/d) from the 1974 level of 55.8 million bb/d. By April, 1976 world production had risen to 55.0 million bb/d. Table 1 gives the crude oil production for major petroleum exporting countries for 1973 through April 1976. Between May 1975 and April 1976 only two exporters' production capacity increased, Iraq and Mexico, by a total of 450,000 bb/d. This was offset by a decline in other exporters' production capacity of 660,000 bb/d.

Between May 1975 and April 1976 there were major changes in the shut-in production capacities of the petroleum exporting countries including OPEC, Canada, and Mexico. For the group as a whole shut-in production capacity decreased to 25.3 percent from 32.2 percent of total production capacity. But within this overall reduction four countries increased their shut-in capacity during the 11-month period — Iraq, to 48.3 percent from 9.2 percent, Kuwait to 46.0 percent from 44.9 percent, Canada to 42.2 percent from 24.2 percent and Mexico to 5.9 percent from zero.

Crude petroleum prices are largely the result of political decisions concerning tax and royalty payments to governments. OPEC has provided a means for the governments of petroleum exporting countries to co-

\*The cut-off date for new information in this article was October 14, 1976. Hence, energy developments after October 14 are not discussed.

\*\*Dr. O.R. Morris is an economist in the Farm and Rural Development Division, Economics Branch, Agriculture Canada, Ottawa.

TABLE 1. CRUDE OIL PRODUCTION FOR MAJOR PETROLEUM EXPORTING COUNTRIES — APRIL 1976

| Country                     | Production                       |        |        |            | Production Capacity |          | Production Shut in |          |
|-----------------------------|----------------------------------|--------|--------|------------|---------------------|----------|--------------------|----------|
|                             | 1973                             | 1974   | 1975   | April 1976 | April 1976          | May 1975 | April 1976         | May 1975 |
|                             | — thousands of barrels per day — |        |        |            | — percent —         |          |                    |          |
| Algeria                     | 1,070                            | 960    | 930    | 1,000      | 1,000               | 1,100    | 0                  | 12.5     |
| Iraq                        | 2,015                            | 1,975  | 2,250  | 1,550      | 3,000               | 2,600    | 48.3               | 9.2      |
| Kuwait*                     | 3,020                            | 2,545  | 2,100  | 1,890      | 3,500               | 3,500    | 46.0               | 44.9     |
| Libya                       | 2,175                            | 1,520  | 1,520  | 1,860      | 2,500               | 3,000    | 25.6               | 61.3     |
| Qatar                       | 570                              | 520    | 440    | 490        | 700                 | 700      | 30.0               | 32.9     |
| Saudia Arabia*              | 7,600                            | 8,480  | 7,080  | 8,270      | 11,500              | 11,500   | 28.1               | 39.2     |
| United Arab Emirates        | 1,530                            | 1,680  | 1,700  | 1,880      | 2,360               | 2,400    | 20.3               | 28.8     |
| Subtotal: Arab OPEC         | 17,980                           | 17,680 | 16,020 | 16,940     | 24,560              | 24,400   | 31.0               | 37.4     |
| Ecuador                     | 210                              | 175    | 160    | 200        | 200                 | 240      | 0                  | 54.2     |
| Gabon                       | 150                              | 200    | 220    | 220        | 250                 | 250      | 12.0               | 16.0     |
| Indonesia                   | 1,340                            | 1,375  | 1,310  | 1,530      | 1,700               | 1,700    | 10.0               | 31.8     |
| Iran                        | 5,860                            | 6,020  | 5,350  | 5,500      | 6,500               | 6,500    | 15.4               | 21.7     |
| Nigeria                     | 2,055                            | 2,255  | 1,790  | 2,060      | 2,500               | 2,500    | 17.6               | 37.6     |
| Venezuela                   | 3,365                            | 2,975  | 2,350  | 2,400      | 2,900               | 3,100    | 17.2               | 21.9     |
| Subtotal: Non-Arab OPEC     | 12,980                           | 13,000 | 11,180 | 11,910     | 14,050              | 14,290   | 15.2               | 26.2     |
| Total: OPEC                 | 30,960                           | 30,680 | 27,200 | 28,850     | 38,610              | 38,690   | 25.3               | 33.2     |
| Canada                      | 1,800                            | 1,695  | 1,470  | 1,160      | 1,800               | 1,980    | 42.2               | 24.2     |
| Mexico                      | 465                              | 580    | 720    | 800        | 850                 | 800      | 5.9                | 0.0      |
| Total: OPEC, Canada, Mexico | 33,225                           | 32,955 | 29,390 | 30,810     | 41,260              | 41,470   | 25.3               | 32.2     |
| Total World                 | 55,740                           | 55,885 | 53,170 | 55,000     | n.a.                | n.a.     | n.a.               | n.a.     |

\*Includes about one-half of Neutral Zone production which amounted to approximately 400,000 barrels per day in April.

Source: Reproduced from *Monthly Energy Review*, Federal Energy Administration, National Energy Information Center, Washington, D.C., July 1976, August, 1975.

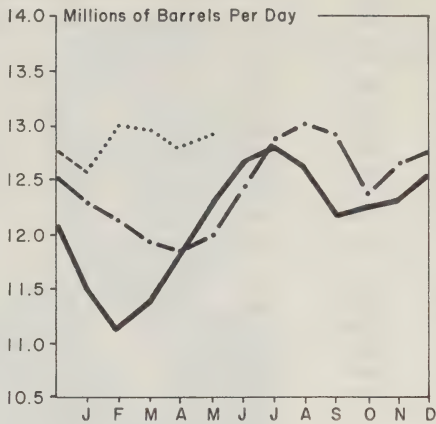
ordinate their price policies; otherwise, one country's price increase benefits those countries that do not increase their prices. The OPEC Oil Ministers meet semi-annually to set a price for the following six-month period. They met in Bali, Indonesia on May 27 and 28, 1976 and agreed, with one exception, to maintain the status quo. The scheduled three-day meeting broke up early because of a confrontation on the subject of a general price increase. Ecuador, Gabon, Indonesia, Iraq, Libya, Nigeria and Qatar wanted a 20-percent price increase to offset the higher costs of goods and services imported from oil-consuming countries. Saudi Arabia opposed any price increases whatsoever; its position prevailed despite a willingness of other countries to accept a compromise price increase of less than 20 percent.

A positive decision to emerge from the May OPEC meeting was to replace the system of price differentials reflecting the differences in specific gravity, sulfur content and transportation factors from those of

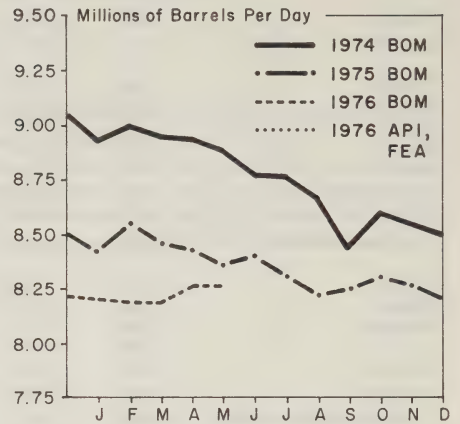
Arabian light crude, the most widely traded crude-oil type in the world. The previous price differential system had created tension among the OPEC members, particularly for those countries that experienced difficulties in marketing their lower quality crude petroleum. At the Bali meeting "price bands" for the heavier crude types were developed. Each country now has discretionary price-setting powers, within the established "price band" which they feel are more appropriate for current market conditions and still acceptable to the OPEC member nations.

As a result of the newly agreed "price bands" the price of heavy Arabian crude decreased by 10 cents per barrel to \$11.04 per barrel. For the high quality Libyan crude, which yields a higher proportion of lighter, more expensive products (e.g., gasoline and light fuel oil), price increases of 18 to 30 cents per barrel became effective. Venezuela instituted a 10-cents-per-barrel increase on its heavier crudes that are marketed in the Caribbean where high sulfur fuel oils are used.

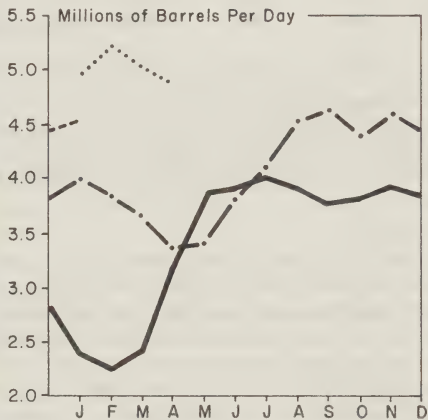
### Crude Input to Refineries



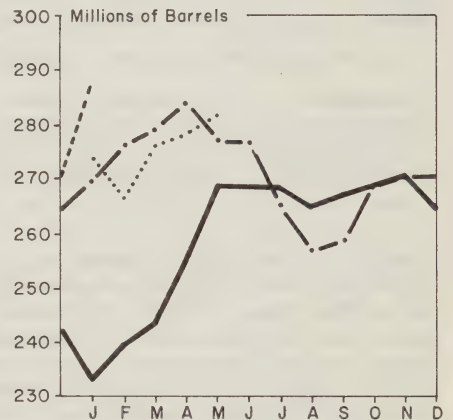
### Domestic Production



### Imports



### Stocks



BOM = U.S. Bureau of Mines.  
 API = American Petroleum Institute.  
 FEA = U.S. Federal Energy Administration.

Source: Monthly Energy Review, Federal Energy Administration, National Energy Information Center, Washington D.C., July 1976.

Figure 1

The next OPEC ministerial meeting is scheduled for December 15, 1976 at Doha, Qatar to determine OPEC prices for early 1977. To date, indications are that the Saudi Arabia policy towards price increases is changing. The world-wide use of OPEC crude oil rose 7.9 percent during the first half of 1976 over the first half of 1975. It is reported that Saudi Arabia will favor a 10-percent price increase in light of the increased use of OPEC petroleum and the extra 15.25 cents per barrel that Libya and Nigeria were charging for their lighter oil during mid-1976. The Saudi Arabia government judges that the industrialized nations can now absorb a 10-percent increase without decreasing their consumption.

## **NORTH AMERICAN SITUATION**

### **U.S. Crude Oil**

The U.S. crude oil situation for the period January 1, 1974 to May 1976 is shown in Figure 1. The crude input to U.S. refineries was significantly greater during the first five months of 1976 than a year ago and showed an increasing trend while downward trends occurred during the same five-month period in both 1974 and 1975. Daily domestic production of U.S. crude oil has followed a persistently downward trend since January 1973, when U.S. domestic production was 9.2 million bb/d; in January 1974, 8.9 million bb/d, January 1975, 8.4 million bb/d; January 1976, 8.2 million bb/d. However, some indications are that the rate of decline has slowed. U.S. imports of crude oil have followed a rising trend since February 1974 with a notable decline between February 1975 and June 1975. This same pattern in U.S. imports is apparent in 1976 but sufficient data are not available to determine if this is a seasonal feature. U.S. stocks of crude petroleum have risen from a low in February 1974. This is due to a policy of maintaining larger reserves to combat the effects of another oil embargo such as was imposed in October 1973.

Monthly price information for 1974 through March 1976 is given in Table 2. The composite price is most representative of crude oil costs to U.S. refiners. It reached its highest level of \$11.05 per barrel in November 1975 but since then it has decreased to an estimated \$10.14 per barrel in March 1976.

### **U.S. Energy Policy**

On December 22, 1975, President Ford signed into law the Energy Policy and Conservation Act of 1975. This Act represents the most comprehensive energy legislation Congress had passed since the Arab oil embargo.

For the first time the U.S. government considered energy conservation as an urgently needed peacetime practice rather than merely a wartime measure. Also, Congress gave the President authority to take action in anticipation of energy shortages such as the 1973 Arab embargo. This authority includes creating a strategic oil reserve and to some extent this is already reflected in the higher crude oil stocks depicted in Figure 1 above. In addition, the Act (1) includes a general formula for controlling U.S. domestic crude oil prices, through May 1979; (2) renews the authority to order utilities and large users of oil and natural gas to convert to coal, which is the most abundant energy form in the country; (3) provides emergency powers for domestic oil allocation and rationing (subject to Congressional approval); (4) includes provisions for mandatory automobile efficiency standards and for mandatory labelling of appliances to show energy use, and (5) permits federal posting of voluntary energy efficiency standards for appliances and for the 10 most energy-intensive industries.

This Act is a substantial start toward enactment of 13 major energy bills President Ford sent to Congress in January 1975. However, the Act did not phase out oil price controls rapidly as President Ford wanted. Also, the Administration was forced to accept statutory, instead of voluntary, automobile efficiency standards.

The U.S. Energy Policy and Conservation Act of 1975 is weaker than the Administration and some Congressional members sought. It does, however, establish a legislative principle and it provides existing legislation that can later be amended. Amending existing legislation is much easier than passing a new policy.

### **Energy Use in U.S. Agriculture**

It is useful to review, briefly, energy use in U.S. agriculture because of the parallels with Canadian agriculture.

The five million tractors, three million trucks, one million grain combines and cornpickers as well as other specialized units currently in use in U.S. agriculture consume more than 18 million gallons per day of gasoline, diesel fuel and L.P. gas.

Irrigation and crop drying also consume large amounts of energy. To power U.S. irrigation systems nearly 6 million gallons per day of diesel fuel, L.P. gas and their equivalents of natural gas and electricity are required. It is estimated that more than half the U.S. corn crop is mechanically dried with L.P. and natural gases. About 4 million gallons per day of these fuels are required.

**TABLE 2. CRUDE PETROLEUM PRICES IN THE UNITED STATES, BY MONTH 1974-1976**

|                        | Domestic Crude Petroleum<br>Prices at the Wellhead |                |                     | Refiner Acquisition<br>Cost of Crude Petroleum |          |           |
|------------------------|--|----------------|---------------------|--|----------|-----------|
|                        | Old  | New            | Domestic<br>Average | Domestic                                       | Imported | Composite |
| — dollars per barrel — |  |                |                     |  |          |           |
| <b>1974</b>            |  |                |                     |  |          |           |
| January                | R5.03  | 9.82           | 6.95                | 6.72   | 9.59     | 7.46      |
| February               | R5.03  | 9.87           | 6.87                | 7.08   | 12.45    | 8.57      |
| March                  | R5.03  | 9.88           | 6.77                | 7.05   | 12.73    | 8.68      |
| April                  | R5.03  | 9.88           | 6.77                | 7.21   | 12.72    | 9.13      |
| May                    | R5.03  | 9.88           | 6.87                | 7.26   | 13.02    | 9.44      |
| June                   | R5.03  | 9.95           | 6.85                | 7.20   | 13.06    | 9.45      |
| July                   | R5.03  | 9.95           | 6.80                | 7.19   | 12.75    | 9.30      |
| August                 | R5.03  | 9.98           | 6.71                | 7.20   | 12.68    | 9.17      |
| September              | R5.03  | 10.10          | 6.70                | 7.18   | 12.53    | 9.13      |
| October                | R5.03  | 10.74          | 6.97                | 7.26   | 12.44    | 9.22      |
| November               | R5.03  | 10.90          | 6.97                | 7.46   | 12.53    | 9.41      |
| December               | R5.03  | 11.08          | 7.09                | 7.39   | 12.82    | 9.28      |
| Average                | R5.03  | 10.13          | 6.87                | 7.18   | 12.52    | 9.07      |
| <b>1975</b>            |  |                |                     |  |          |           |
| January                | R5.03  | 11.28          | 7.61                | 7.78   | 12.77    | 9.48      |
| February               | R5.03  | 11.39          | 7.47                | 8.29   | 13.05    | 10.09     |
| March                  | R5.03  | 11.47          | 7.57                | 8.38   | 13.28    | 9.91      |
| April                  | R5.03  | 11.64          | 7.55                | 8.23   | 13.26    | 9.83      |
| May                    | R5.03  | 11.69          | 7.52                | 8.33   | 13.27    | 9.79      |
| June                   | R5.03  | 11.73          | 7.49                | 8.33   | 14.15    | 10.33     |
| July                   | R5.03  | 12.30          | 7.75                | 8.37   | 14.03    | 10.57     |
| August                 | R5.03  | 12.38          | 7.73                | 8.48   | 14.25    | 10.81     |
| September              | R5.03  | 12.46          | 7.75                | 8.49   | 14.04    | 10.79     |
| October                | R5.03  | 12.73          | 7.83                | 8.68   | 14.66    | 10.85     |
| November               | R5.03  | 12.89          | 7.80                | 8.67   | 15.04    | 11.05     |
| December               | R5.03  | 12.95          | 7.93                | 8.66   | 14.81    | 10.98     |
| Average                | R5.03  | 12.03          | 7.67                | 8.39   | 13.93    | 10.38     |
| <b>1976</b>            |  |                |                     |  |          |           |
| January                | R5.02  | 12.99          | 8.63                | R9.14  | 13.27    | 10.76     |
|                        | Lower<br>Tier*                                     | Upper<br>Tier* |                     |  |          |           |
| February               | R5.07  | 11.29**        | 7.66**              | 8.50**   | 13.21**  | 10.31**   |
| March                  | R5.10  | 11.38**        | n.a.                | 8.24**   | 13.27**  | 10.14**   |

\* Lower tier is old crude oil and upper tier is new crude oil and crude oil produced from a stripper well lease.

\*\* Preliminary figure based on early reports

R = Revised data, n.a. = not available.

Source: *Monthly Energy Review*, Federal Energy Administration, National Energy Information Center, Washington D.C., July 1976.

The following table shows the trend of energy use in U.S. farm production expressed in thousands of barrels daily of oil equivalent including electricity converted on the basis of energy required to produce electricity.

Between 1950 and 1975 electricity use on U.S. farms increased from 15 billion kilowatt-hours per year to 39

billion kilowatt-hours. About three quarters were required for crop irrigation.

Like other industries, U.S. agriculture already is searching for ways to improve its efficiency in energy use. Diesel tractors are replacing gasoline tractors, the former requiring only three quarters as much fuel as the

**TABLE — ENERGY USED IN U.S. FARM PRODUCTION**

| — 1000 bb/d oil equivalent — |             |                   |       |   |
|------------------------------|-------------|-------------------|-------|---|
| Year                         | Vehicle Use | Other Energy Uses | Total | Farm Use as a Percent of Total Energy Use |
| 1940                         | 130         | 4                 | 170   | 1.5                                       |
| 1950                         | 290         | 130               | 420   | 2.6                                       |
| 1960                         | 320         | 240               | 560   | 2.6                                       |
| 1970                         | 390         | 330               | 720   | 2.2                                       |
| 1975                         | 410         | 400               | 810   | 2.4                                       |

Source: *Energy Report from Chase*. Economics Division, Chase Manhattan Bank, New York. June 1975.

gasoline tractor. During 1974 and 1975, 90 percent of the new tractors purchased were diesel powered. Other measures include:

1. Reduced crop tillage and more selective pesticide applications.
2. Improved scheduling of irrigation operations.
3. Greater use of animal wastes and crop rotations to reduce dependence on manufactured fertilizer.

While only 2.4 percent of U.S. energy is used directly in farming, another 8 percent is used by agriculture-related industries. So long as the physical volume of U.S. farm production expands at an average annual rate of approximately 2 percent, then an additional 20 million gallons per day of oil equivalent will be required in the late 1980s for farming and agriculture-related industries.

Under the allocation authority of the Energy Policy and Conservation Act of 1975, the United States is trying to maintain the same relationships between energy producers and consumers that existed prior to the 1973 Arab oil embargo. This principle basically ensures that U.S. agriculture will continue to be well supplied with energy resources.

## Outlook for U.S. Petroleum

The outlook for U.S. petroleum is for higher crude oil prices in light of the expected increased OPEC crude oil prices for early 1977. Offshore imports and upper tier crude oil form a significant input to U.S. refineries. In the United States upper tier oil is priced comparably with imported supplies as can be seen in Table 2 above.

1976 is a presidential election year. At this time, it is difficult to determine what represents genuine feelings

towards amending U.S. energy policies and what is campaign rhetoric.

## U.S. Natural Gas Situation

The U.S. natural gas situation for the period January 1974 through spring 1976 is shown in Figure 2. The data reflect a definite decline in natural gas use in the United States. Domestic consumption, marketed production and domestic producer sales to major interstate pipeline companies during 1975 and early 1976 were all lower than one year earlier. Imports of natural gas from 1974 through May 1976 have closely followed their seasonal patterns and levels throughout. This is due primarily to contracted deliveries from Canada that were established prior to 1973.

Two basic markets operate for U.S. natural gas, the intrastate market, which is regulated by the respective state in which the gas is produced and consumed and the interstate market, where gas is produced in one state and consumed in another state. Commercial trading of interstate gas is regulated by the U.S. Federal Power Commission (FPC).

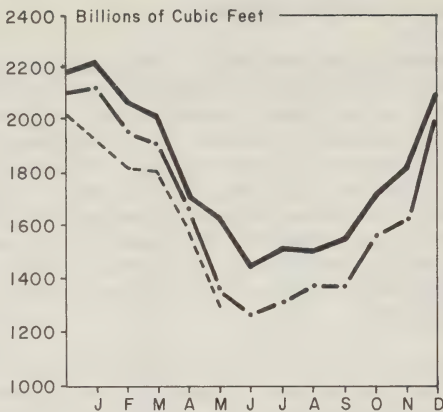
A distinction between old gas — gas coming from wells brought into production before January 1, 1973 — and new gas — gas coming from wells brought into production after January 1, 1973 — must be made. Natural gas is sold under contracts some of which have ended since January 1, 1973 and have been renegotiated. Old natural gas sold to major interstate pipeline companies under renegotiated contracts is priced at the same level as newly produced gas.

Natural gas contracted prior to 1973 for delivery by major interstate pipeline companies is priced at \$.51 per thousand cubic feet (mcf) by the FPC. Informed sources estimate that approximately 88 percent of the gas transported by U.S. major interstate pipeline companies was under contracts negotiated prior to January 1973.

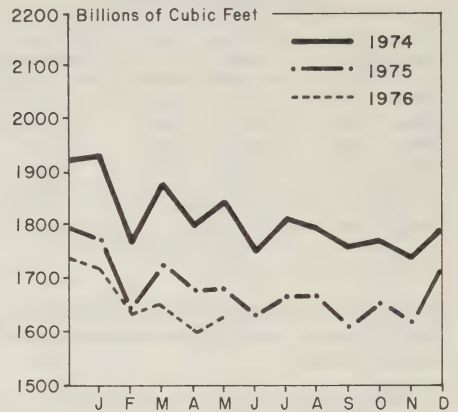
During 1976 the FPC amended the prices for new and renegotiated natural gas. For natural gas coming into production or contracts renegotiated between January 1, 1973 and December 31, 1974 the price was set at \$1.01 per mcf with a \$.02/mcf annual escalation provision. For new and renegotiated natural gas beginning January 1, 1975 through December 31, 1976 the price was set at \$1.42 per mcf subject to a \$.04/mcf annual escalation provision.

These FPC decisions were appealed on administrative grounds and the appeal was upheld in the U.S. courts. At

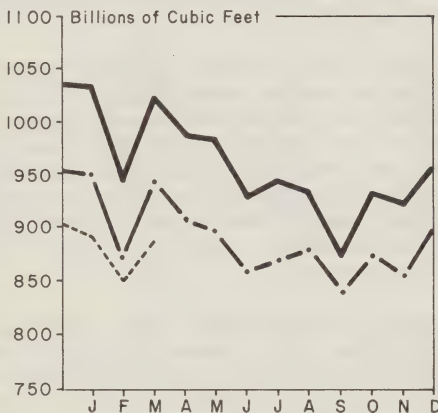
### Domestic Consumption



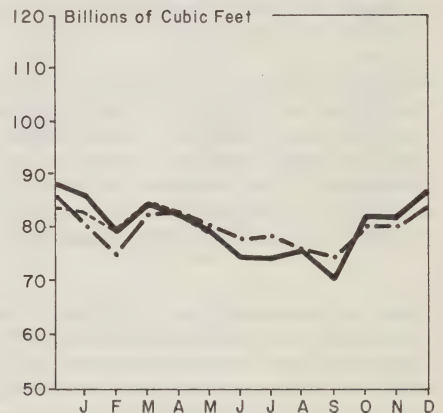
### Marketed Production



### Domestic Producer Sales to Major Interstate Pipeline



### Imports



Source: Reproduced from Monthly Energy Review, Federal Energy Administration, National Energy Information Center, Washington D.C., July 1976.

Figure 2

present the FPC is reconsidering its price-setting decisions. After October 27, 1976 parties can appeal the FPC price rulings if they feel the FPC has exceeded its authority under the U.S. Natural Gas Act.

The FPC sets natural gas prices to major interstate pipeline companies bi-annually. This process will begin again in early 1977. However, one must remember that any new FPC rulings will affect only about 11–12 percent of the U.S. natural gas sold to major interstate pipeline companies. The average price for natural gas sold to major interstate pipeline companies was \$.53/mcf during the first half of 1976.

The FPC has provisions for 60-day emergency sales whereby major interstate pipeline companies can purchase natural gas at intrastate prices (up to \$2.00/mcf in some cases) and pass on the increased costs to their consumers. Also, industrial consumers can purchase natural gas directly on intrastate markets and have it transported by major pipeline companies at fixed transportation rates for their own use.

### Outlook for U.S. Natural Gas

Increased prices are projected for U.S. natural gas users as more industrial users purchase on intrastate markets and pay the transportation charges, rather than face a curtailment in supply. An 18-percent shortfall is expected in the interstate markets. This will result in

curtailments to some users, especially those with a low allocation priority.

### Canadian Petroleum Situation

The principle of a single crude oil price for Canadian refiners, adjusted for location, transportation and quality differences, was accepted at the January 1974 conference of Canadian First Ministers. This principle is still used today. The Canadian First Ministers met on May 6, 1976 to establish a price for Canadian crude oil from July 1, 1976 through June 30, 1977.

Effective July 1, 1976 a well-head price for Canadian crude oil of \$9.05/bb, up from \$8.00/bb, was established. This price is effective through December 31, 1976. On September 1, 1976 retail gasoline prices rose 5 cents a gallon in response to the oil price increase. For the period January 1, 1977 through June 30, 1977 the well-head price will rise to \$9.75/bb.

Table 3 contains quarterly data on Canada's petroleum situation for January 1974 through March 1976. Canadian crude oil exports to the United States have followed a downward trend over this period following their announced phasing out by 1983. During the first quarter Canadian crude oil exports to the United States were reduced to 511,400 bb/d from their October-December 1975 level of 743,000 bb/d while imports declined from 820,800 bb/d to 797,700 bb/d. As a

**TABLE 3. AVERAGE DAILY RECEIPTS OF CANADIAN CRUDE OIL REFINERS, AVERAGE DAILY IMPORT RATES AND AVERAGE DAILY EXPORT RATES OF CRUDE OIL TO AND FROM CANADA, 1974–76**

| Year and Quarter                                  | Received by Canadian Refiners from Domestic Sources <sup>a</sup> | Imports to Canada <sup>a</sup> | Total Received by Canadian Refiners | Export to U.S.A. <sup>b</sup> | Net Exports |
|---|--|--------------------------------|-------------------------------------|-------------------------------|-------------|
| — thousand barrels of 35 Canadian gallons a day — |  |                                |                                     |                               |             |
| 1974  |  |                                |                                     |                               |             |
| 1   | 992.0  | 822.8                          | 1,814.8                             | 975.1                         | 152.3       |
| 2   | 963.6  | 812.9                          | 1,776.5                             | 947.1                         | 134.2       |
| 3   | 935.5  | 800.2                          | 1,735.7                             | 849.7                         | 49.5        |
| 4   | 907.3  | 840.8                          | 1,748.1                             | 873.3                         | — 32.5      |
| 1975  |  |                                |                                     |                               |             |
| 1   | 872.7  | 853.5                          | 1,726.2                             | 735.1                         | —118.4      |
| 2   | 859.8  | 871.9                          | 1,731.7                             | 600.1                         | —271.8      |
| 3   | 898.5  | 749.4                          | 1,647.9                             | 747.1                         | — 2.3       |
| 4   | 881.0  | 820.8                          | 1,701.8                             | 743.0                         | — 77.8      |
| 1976  |  |                                |                                     |                               |             |
| 1   | 875.1  | 797.7                          | 1,672.8                             | 511.4                         | —286.3      |
| 2   | n.a.   | n.a.                           | n.a.                                | 500.6                         | n.a.        |

<sup>a</sup>Calculated from data taken from Refined Petroleum Products, Statistics Canada, Catalogue No. 45–004.

<sup>b</sup>Data provided by Department of Energy, Mines and Resources.

result, Canada's net importer status rose to 286,300 bb/d.

**TABLE 4. PRODUCTION, NET SALES AND CLOSING INVENTORIES OF MOTOR GASOLINE, DIESEL FUEL OIL, LIGHT FUEL OIL AND LIQUIDIFIED PETROLEUM GASES, IN CANADA, 1964-68, 1969-73 TO 1976**

| Year and Quarter | Motor Gasoline | Diesel Fuel Oil | Light Fuel Oil <sup>a</sup> | Liquidified Petroleum Gases |
|------------------|----------------|-----------------|-----------------------------|-----------------------------|
|------------------|----------------|-----------------|-----------------------------|-----------------------------|

— thousand barrels of 35 Canadian gallons —

|             |         |        |         |        |       |
|-------------|---------|--------|---------|--------|-------|
| 1976        |         |        |         |        |       |
| 1           | 53,524  | 16,778 | 32,903  | 3,153  | March |
| 1975        | 220,726 | 71,884 | 108,463 | 10,064 |       |
| 1           | 51,908  | 14,577 | 30,949  | 2,675  | March |
| 2           | 54,474  | 19,322 | 26,029  | 2,363  | June  |
| 3           | 57,089  | 18,964 | 23,291  | 2,470  | Sept. |
| 4           | 57,255  | 19,021 | 28,194  | 2,556  | Dec.  |
| 1974        | 212,785 | 72,497 | 118,877 | 8,791  |       |
| 1           | 51,327  | 16,190 | 34,979  | 2,154  | March |
| 2           | 50,940  | 19,689 | 25,366  | 1,951  | June  |
| 3           | 56,076  | 19,356 | 26,374  | 2,352  | Sept. |
| 4           | 54,442  | 17,262 | 32,158  | 2,334  | Dec.  |
| 1973        | 201,230 | 69,494 | 118,202 | 7,936  |       |
| 1           | 45,333  | 15,906 | 33,673  | 1,997  | March |
| 2           | 47,808  | 17,926 | 22,896  | 1,705  | June  |
| 3           | 55,718  | 18,556 | 28,895  | 2,260  | Sept. |
| 4           | 52,371  | 17,106 | 32,738  | 1,974  | Dec.  |
| 1972        | 185,410 | 64,747 | 107,543 | 6,980  |       |
| 1           | 43,815  | 13,715 | 30,952  | 1,684  | March |
| 2           | 41,946  | 16,273 | 21,649  | 1,654  | June  |
| 3           | 50,915  | 18,042 | 25,536  | 1,974  | Sept. |
| 4           | 48,734  | 16,717 | 29,406  | 1,668  | Dec.  |
| Av. 1969-73 | 174,486 | 59,907 | 102,112 | 7,928  |       |
| Av. 1964-68 | 134,541 | 42,387 | 80,498  | 8,607  |       |

— net sales —

|      |         |        |         |        |       |
|------|---------|--------|---------|--------|-------|
| 1976 |         |        |         |        |       |
| 1    | 48,831  | 15,400 | 52,327  | 12,450 | March |
| 1975 | 217,238 | 68,581 | 117,834 | 8,264  |       |
| 1    | 46,904  | 14,367 | 50,150  | 1,821  | March |
| 2    | 55,513  | 17,703 | 21,956  | 2,277  | June  |
| 3    | 60,146  | 19,236 | 10,529  | 2,378  | Sept. |
| 4    | 54,675  | 17,274 | 35,199  | 1,788  | Dec.  |
| 1974 | 209,199 | 68,048 | 125,078 | 6,533  |       |
| 1    | 45,569  | 14,699 | 54,603  | 1,717  | March |
| 2    | 52,273  | 17,328 | 22,647  | 1,387  | June  |
| 3    | 58,593  | 17,952 | 9,102   | 1,679  | Sept. |
| 4    | 52,764  | 18,069 | 38,726  | 1,750  | Dec.  |
| 1973 | 203,406 | 62,394 | 124,361 | 6,183  |       |
| 1    | 43,284  | 12,995 | 51,470  | 1,670  | March |
| 2    | 50,688  | 15,722 | 20,928  | 1,346  | June  |
| 3    | 58,005  | 17,004 | 11,709  | 1,658  | Sept. |
| 4    | 51,429  | 16,673 | 40,254  | 1,509  | Dec.  |

| Year and Quarter | Motor Gasoline | Diesel Fuel Oil | Light Fuel Oil <sup>a</sup> | Liquidified Petroleum Gases |       |
|------------------|----------------|-----------------|-----------------------------|-----------------------------|-------|
| 1972             | 184,541        | 55,565          | 130,363                     | 6,118                       |       |
| 1                | 39,632         | 11,734          | 56,090                      | 1,603                       | March |
| 2                | 45,862         | 14,314          | 20,827                      | 1,334                       | June  |
| 3                | 52,611         | 15,140          | 10,558                      | 1,565                       | Sept. |
| 4                | 46,436         | 14,377          | 42,888                      | 1,616                       | Dec.  |
| Av. 1969-73      | 177,696        | 52,420          | 122,425                     | 5,529                       |       |
| Av. 1964-68      | 136,395        | 38,294          | 100,504                     | 5,959                       |       |

— closing inventories —

|             |        |        |        |       |       |
|-------------|--------|--------|--------|-------|-------|
| 1976        |        |        |        |       |       |
| 1           | 32,744 | 11,261 | 19,385 | 1,056 | March |
| 1975        | 26,426 | 14,566 | 33,844 | 573   |       |
| 1           | 30,228 | 12,342 | 26,264 | 571   | March |
| 2           | 26,552 | 14,200 | 30,811 | 642   | June  |
| 3           | 23,343 | 16,705 | 41,268 | 597   | Sept. |
| 4           | 25,746 | 15,066 | 34,327 | 455   | Dec.  |
| 1974        | 24,686 | 14,627 | 32,912 | 544   |       |
| 1           | 26,322 | 11,296 | 24,020 | 606   | March |
| 2           | 25,972 | 13,409 | 37,638 | 570   | June  |
| 3           | 23,618 | 18,937 | 42,093 | 566   | Sept. |
| 4           | 25,006 | 15,973 | 39,680 | 563   | Dec.  |
| 1973        | 21,543 | 14,875 | 36,422 | 592   |       |
| 1           | 25,937 | 11,484 | 17,085 | 360   | March |
| 2           | 21,749 | 12,474 | 21,013 | 471   | June  |
| 3           | 20,497 | 16,374 | 39,085 | 513   | Sept. |
| 4           | 21,543 | 14,875 | 36,422 | 592   | Dec.  |
| 1972        | 22,991 | 13,579 | 29,312 | 377   |       |
| 1           | 25,461 | 10,419 | 15,490 | 340   | March |
| 2           | 22,106 | 11,587 | 19,995 | 387   | June  |
| 3           | 20,929 | 14,921 | 36,945 | 428   | Sept. |
| 4           | 22,991 | 13,579 | 29,312 | 377   | Dec.  |
| Av. 1969-73 | 23,320 | 13,149 | 31,760 | 451   |       |
| Av. 1964-68 | 21,312 | 9,303  | 28,702 | 463   |       |

<sup>a</sup>Includes stove oil, kerosene and tractor fuel.

Source: Canadian Statistical Review, Catalogue No.11-505 and 11-003, Statistics Canada.

Information on the Canadian energy situation is given in Tables 4 to 9. The following are highlights from the tables.

●Gasoline and liquidified petroleum gas production during 1975 exceeded the 1974 output while total output of diesel fuel oil and light fuel oil declined. However, in the first quarter of 1976, production of these fuels exceeded the 1975 first quarter levels (Table 4).

●Except for light fuel oil, net sales of other fuels were higher in 1975 (Table 4).

**TABLE 5. NET SALES OF PETROLEUM PRODUCTS AVAILABLE FOR DISTRIBUTION IN CANADA, BY PROVINCE, YEAR (1964–68, 1969–73 TO 1975), AND PRODUCT.**

| Year  | Atlantic<br>Provinces | Quebec | Ontario | Prairies | B.C.   | Canada <sup>a</sup> |
|---|-----------------------|--------|---------|----------|--------|---------------------|
| — thousand barrels of 35 Canadian gallons — |                       |        |         |          |        |                     |
| <u>Motor Gasoline</u>                       |                       |        |         |          |        |                     |
| 1975  | n.a.                  | n.a.   | n.a.    | n.a.     | n.a.   | 217,238             |
| 1974  | 17,904                | 49,641 | 75,333  | 42,797   | 22,050 | 208,288             |
| 1973  | 16,727                | 50,178 | 73,230  | 39,528   | 20,631 | 200,839             |
| 1972  | 15,619                | 44,396 | 68,503  | 37,433   | 19,050 | 185,495             |
| Av. 1969–73                                 | 14,293                | 43,556 | 64,951  | 35,993   | 17,915 | 177,160             |
| Av. 1964–68                                 | 10,205                | 32,493 | 50,186  | 29,893   | 13,207 | 136,267             |
| <u>Light Fuel Oil</u>                       |                       |        |         |          |        |                     |
| 1975  | n.a.                  | n.a.   | n.a.    | n.a.     | n.a.   | 117,834             |
| 1974  | 17,552                | 39,291 | 38,403  | 4,024    | 6,377  | 106,423             |
| 1973  | 17,006                | 41,678 | 37,042  | 5,030    | 6,780  | 108,235             |
| 1972  | 17,356                | 41,133 | 41,848  | 4,449    | 7,428  | 112,829             |
| Av. 1969–73                                 | 14,608                | 38,850 | 39,453  | 4,553    | 6,564  | 104,594             |
| Av. 1964–68                                 | 9,429                 | 27,926 | 34,227  | 4,838    | 4,802  | 81,588              |
| <u>Diesel Fuel Oil</u>                      |                       |        |         |          |        |                     |
| 1975  | n.a.                  | n.a.   | n.a.    | n.a.     | n.a.   | 68,581              |
| 1974  | 8,611                 | 13,466 | 15,685  | 18,862   | 11,222 | 69,288              |
| 1973  | 7,682                 | 12,676 | 14,341  | 16,018   | 10,545 | 62,661              |
| 1972  | 7,384                 | 9,943  | 12,200  | 15,126   | 9,448  | 55,391              |
| Av. 1969–73                                 | 6,986                 | 9,625  | 11,739  | 14,273   | 8,743  | 52,506              |
| Av. 1964–68                                 | 5,311                 | 7,433  | 7,819   | 11,368   | 6,088  | 38,433              |
| <u>Kerosene and Stove Oil</u>               |                       |        |         |          |        |                     |
| 1975  | n.a.                  | n.a.   | n.a.    | n.a.     | n.a.   | n.a.                |
| 1974  | 4,127                 | 5,209  | 2,514   | 2,816    | 1,396  | 16,407              |
| 1973  | 4,086                 | 6,075  | 2,945   | 2,610    | 1,529  | 17,561              |
| 1972  | 4,854                 | 6,809  | 3,169   | 3,198    | 1,703  | 20,015              |
| Av. 1969–73 <sup>b</sup>                    | 4,495                 | 6,415  | 3,321   | 2,863    | 1,644  | 19,026              |
| Av. 1964–68                                 | 4,158                 | 6,295  | 3,556   | 2,867    | 1,815  | 18,902              |

<sup>a</sup>Includes Northwest Territories and Yukon.

<sup>b</sup>Includes tractor fuel oil for the year 1969.

Source: Refined Petroleum Products, Catalogue No. 45–208, Statistics Canada; Canadian Statistical Review, Statistics Canada.

●Closing inventories of petroleum fuels used by farmers are at normal, sufficient levels (Table 4).

●The farm price indexes for petroleum products increased significantly throughout 1975 and the first half of 1976, with some softening during the second quarter of 1976.

●Farmers' current expenditures during 1975 for fuel and oil increased while their real value in terms of 1961 dollars decreased. Both their current and real expenditures for electricity increased in 1975.

## Canadian Natural Gas Situation

On July 1, 1976 the Toronto city-gate price for Canadian natural gas increased by \$0.155 per thousand cubic feet (mcf) to \$1.405/mcf. On January 1, 1977 it will rise to \$1.505/mcf. These increases are needed to maintain the price relationship between Canadian crude petroleum and Canadian natural gas. If natural gas prices do not increase by these amounts there will be an increasing demand for Canadian natural gas whose supply, at least in the short and medium terms, is barely adequate to meet existing needs.

**TABLE 6. NET SALES OF MOTOR GASOLINE AND DIESEL FUEL OIL, TO FARMS FOR CANADA, BY PROVINCE, YEAR (1964-68, 1969-73 TO 1975), AND PRODUCT.**

| Year  | Atlantic<br>Provinces | Quebec | Ontario | Prairies | B.C.  | Canada <sup>a</sup> |
|---|-----------------------|--------|---------|----------|-------|---------------------|
| — thousand barrels of 35 Canadian gallons — |                       |        |         |          |       |                     |
| <u>Motor Gasoline</u>                       |                       |        |         |          |       |                     |
| 1975  | n.a.                  | n.a.   | n.a.    | n.a.     | n.a.  | n.a.                |
| 1974  | 1,027                 | 1,564  | 4,316   | 11,293   | 1,098 | 19,324              |
| 1973  | 923                   | 1,803  | 4,238   | 11,491   | 1,047 | 19,532              |
| 1972  | 783                   | 1,534  | 4,417   | 11,169   | 925   | 18,850              |
| Av. 1969-73                                 | 903                   | 1,655  | 4,346   | 10,708   | 920   | 18,555              |
| Av. 1964-68                                 | n.a.                  | n.a.   | n.a.    | n.a.     | n.a.  | n.a.                |
| <u>Diesel Fuel Oil</u>                      |                       |        |         |          |       |                     |
| 1975  | n.a.                  | n.a.   | n.a.    | n.a.     | n.a.  | n.a.                |
| 1974  | 470                   | 593    | 1,348   | 4,841    | 452   | 7,718               |
| 1973  | 413                   | 349    | 1,281   | 4,624    | 415   | 7,087               |
| 1972  | 372                   | 423    | 1,029   | 4,328    | 340   | 6,498               |
| Av. 1969-73                                 | n.a.                  | n.a.   | n.a.    | n.a.     | n.a.  | n.a.                |
| Av. 1964-68                                 | n.a.                  | n.a.   | n.a.    | n.a.     | n.a.  | n.a.                |

<sup>a</sup>Includes Northwest Territories and Yukon.

Source: Refined Petroleum Products, Catalogue No. 45-208, Statistics Canada; Canadian Statistical Review, Statistics Canada.

**TABLE 7. FARM INPUT PRICE INDEX: PETROLEUM PRODUCTS, CANADA 1962 TO 1976.**

| (1961 = 100)        |       |       |        | (1961 = 100)        |       |       |        |
|---------------------|-------|-------|--------|---------------------|-------|-------|--------|
| Year and<br>Quarter | East  | West  | Canada | Year and<br>Quarter | East  | West  | Canada |
|                     |       |       |        | 3                   | 126.4 | 117.4 | 120.4  |
|                     |       |       |        | 4                   | 124.0 | 117.7 | 119.8  |
| 1976                |       |       |        | 1971                | 124.5 | 113.8 | 117.3  |
| 1                   | 214.8 | 188.1 | 196.9  | 1970                | 119.2 | 110.6 | 113.5  |
| 2                   | 213.9 | 187.6 | 196.3  | 1969                | 116.6 | 110.0 | 112.2  |
| 1975                |       |       |        | 1968                | 113.7 | 107.2 | 109.3  |
| 1                   | 191.2 | 164.0 | 173.0  | 1967                | 110.8 | 101.0 | 104.3  |
| 2                   | 172.5 | 143.9 | 153.3  | 1966                | 108.4 | 98.9  | 102.0  |
| 3                   | 175.8 | 148.6 | 157.6  | 1962                | 100.6 | 99.6  | 100.0  |
| 4                   | 202.8 | 177.4 | 185.6  |                     |       |       |        |
|                     | 214.3 | 185.9 | 195.3  |                     |       |       |        |
| 1974                |       |       |        |                     |       |       |        |
| 1                   | 164.1 | 135.2 | 144.7  |                     |       |       |        |
| 2                   | 155.6 | 130.3 | 138.6  |                     |       |       |        |
| 3                   | 155.8 | 126.8 | 136.4  |                     |       |       |        |
| 4                   | 173.0 | 140.6 | 151.3  |                     |       |       |        |
|                     | 172.1 | 143.0 | 152.6  |                     |       |       |        |
| 1973                |       |       |        |                     |       |       |        |
| 1                   | 135.6 | 123.5 | 127.5  |                     |       |       |        |
| 2                   | 125.9 | 120.7 | 122.4  |                     |       |       |        |
| 3                   | 128.7 | 120.9 | 123.5  |                     |       |       |        |
| 4                   | 139.7 | 123.7 | 129.0  |                     |       |       |        |
|                     | 147.9 | 128.5 | 134.9  |                     |       |       |        |
| 1972                |       |       |        |                     |       |       |        |
| 1                   | 125.8 | 117.1 | 120.0  |                     |       |       |        |
| 2                   | 126.4 | 116.4 | 119.7  |                     |       |       |        |
|                     | 126.3 | 116.8 | 119.9  |                     |       |       |        |

More recently a controversy has arisen over the availability and supply of Canadian natural gas. Natural gas producers and pipeline companies are now claiming that natural gas is and will be abundant for several years. Several factors are cited to support this claim:

- higher well-head prices stimulated exploration and development efforts to record levels during the last two years;
- soaring fuel costs have caused large industries to switch to fuel oil, thereby freeing substantial volumes of natural gas, which is now having difficulty finding alternative markets;

**TABLE 8. FARMERS' CURRENT EXPENDITURES FOR ENERGY, ENERGY PRICE INDEXES AND REAL EXPENSES FOR CANADA, 1964-75.**

| Year                     | Fuel and Oil                                  |   |  | Electricity and Telephone                     |   |  |
|--------------------------|---|---|--|---|---|--|
|                          | Current <sup>a</sup><br>Expenses<br>(dollars) | Petroleum <sup>b</sup><br>Index<br>(1961=100) | Adjusted<br>Expenses<br>(1961 dollars) | Current <sup>a</sup><br>Expenses<br>(dollars) | Petroleum <sup>b</sup><br>Index<br>(1961=100) | Adjusted<br>Expenses<br>(1961 dollars) |
| — thousands of dollars — |   |   |  |   |   |  |
| 1975                     | 463,693                                       | 173.0   | 268,031                                | 59,525  | 142.0   | 41,919                                 |
| 1974                     | 398,246                                       | 144.7   | 275,222                                | 52,585  | 129.6   | 40,575                                 |
| 1973                     | 319,116                                       | 127.5   | 250,287                                | 51,737  | 122.1   | 42,373                                 |
| 1972                     | 282,425                                       | 120.0   | 235,354                                | 51,011  | 114.1   | 44,707                                 |
| 1969-73                  | 275,258                                       | 118.1   | 232,621                                | 50,638  | 113.5   | 44,678                                 |
| 1964-68                  | 220,592                                       | 103.5   | 212,919                                | 45,794  | 99.3  | 46,072                                 |

<sup>a</sup>Farm Net Income, Catalogue No. 21-202, Annual, Statistics Canada.

<sup>b</sup>Prices and Price Indexes, Catalogue No. 62-002, Monthly, Statistics Canada.

•less than two years ago gas producers withheld reserves from the market in anticipation of higher prices. These reserves are now being marketed.

•curtailment of gas exports to the United States. The Canadian government objected to sustained exports and U.S. buyers have resisted higher Canadian prices.

These claims of abundant Canadian natural gas have not been adequately appraised as to their accuracy. No comments are made here except to say that the claims appear worthy of serious consideration.

### Electricity Situation and Outlook\*

In the residential and farm categories the growth in consumption has continued at rates higher than the historical averages. For the first five months of 1976, Canadian domestic consumption increased 12.46 percent compared with 9 percent for the same period a year earlier.

Growth rates vary considerably across Canada ranging from 4.9 percent in Saskatchewan to 36 percent in the Northwest Territories. Although Quebec reports reductions in the number of farm accounts, total farm consumption is actually increasing. Domestic energy demand grew 19.24 percent, almost 6 percent above the increase reported in 1975. Demand to the end of May in Ontario and Manitoba increased 6.8 percent and 10.9 percent respectively compared with year-earlier growth rates of 2.4 percent and 5.5 percent. In the Atlantic

region, increases in residential and farm demand are not as sizeable as they were between 1975 and 1974 except for New Brunswick which experienced a 26.2-percent increase to the end of May compared with 20 percent in 1975. This is largely a result of an increase in the number of domestic accounts.

Price increases have been substantial in some regions as efforts continue to balance revenues with increased operating costs. In the longer term it is expected that by increasing electricity rates a greater proportion of the capital requirements needed to finance expanded service for future electrical demand will be generated internally. This will avoid high interest costs on borrowed capital and maintain a higher degree of solvency needed to face increasing construction expenditures.

Because fuel is a major operating expense, variations in rates between provinces result in part from the degree of dependence a utility has on fossil fuels as opposed to its dependence upon hydro-electric sources.

Many utilities have added a fuel adjustment charge in their rate schedules that can be adjusted proportionately to follow changes in fuel costs. The unique advantage of hydro potential is evident in viewing provincial rate increases.

Ontario Hydro's wholesale power costs have increased 22 percent and in Nova Scotia application has been made to the provincial Public Utilities Board for an increase of between 27 and 65 percent depending on category and level of consumption. In Quebec, Newfoundland and New Brunswick rate increases in 1976 were about 10 percent, 13.4 percent and 12 percent respectively.

\*This section was prepared by Mr. Alan Scott and Miss Sue Barrett, Energy Policy Sector, Department of Energy, Mines and Resources, Ottawa.

TABLE 9. ELECTRIC ENERGY AVAILABLE BY PROVINCE, 1964-68, 1969-73 AND 1972-76 BY QUARTERS

| Year                       | Atlantic<br>Provinces | Quebec | Ontario | Prairies | B.C.   | Canada <sup>a</sup> | Net<br>Exports |
|----------------------------|-----------------------|--------|---------|----------|--------|---------------------|----------------|
| — million kilowatt hours — |                       |        |         |          |        |                     |                |
| 1976                       |                       |        |         |          |        |                     |                |
| 1st quarter                | 5,601                 | 26,774 | 25,313  | 9,854    | 9,651  | 77,390              | 1,826          |
| 2nd quarter                | 5,002                 | 23,152 | 22,528  | 8,005    | 8,622  | 67,466              | 2,197          |
| 1975                       |                       |        |         |          |        |                     |                |
| 1st quarter                | 5,403                 | 25,182 | 24,273  | 9,368    | 9,299  | 73,710              | 1,672          |
| 2nd quarter                | 4,427                 | 20,898 | 21,582  | 7,770    | 8,276  | 63,115              | 1,455          |
| 3rd quarter                | 4,080                 | 20,272 | 20,654  | 7,615    | 6,372  | 59,139              | 2,210          |
| 4th quarter                | 4,982                 | 23,385 | 22,666  | 9,458    | 8,732  | 69,418              | 1,931          |
| TOTAL                      | 18,892                | 89,737 | 89,175  | 34,211   | 32,679 | 265,382             | 7,268          |
| 1974                       |                       |        |         |          |        |                     |                |
| 1st quarter                | 4,986                 | 24,804 | 23,614  | 9,204    | 8,850  | 71,623              | 4,049          |
| 2nd quarter                | 4,539                 | 21,612 | 20,967  | 7,651    | 8,070  | 62,980              | 3,347          |
| 3rd quarter                | 4,231                 | 20,530 | 20,776  | 7,559    | 7,541  | 60,782              | 3,485          |
| 4th quarter                | 4,727                 | 24,417 | 23,254  | 8,756    | 8,883  | 70,614              | 2,074          |
| TOTAL                      | 18,883                | 91,363 | 88,611  | 33,170   | 33,344 | 265,999             | 12,955         |
| 1973                       |                       |        |         |          |        |                     |                |
| 1st quarter                | 4,376                 | 21,848 | 22,157  | 8,302    | 8,569  | 65,867              | 3,446          |
| 2nd quarter                | 4,038                 | 19,586 | 19,813  | 7,142    | 7,859  | 58,577              | 3,981          |
| 3rd quarter                | 3,972                 | 18,244 | 19,614  | 7,167    | 7,688  | 56,818              | 4,152          |
| 4th quarter                | 4,577                 | 22,286 | 22,188  | 8,765    | 8,777  | 66,751              | 3,138          |
| TOTAL                      | 16,963                | 81,964 | 83,772  | 31,376   | 32,893 | 248,013             | 14,717         |
| 1972                       |                       |        |         |          |        |                     |                |
| 1st quarter                | 4,046                 | 19,934 | 20,848  | 7,803    | 7,918  | 60,694              | 1,338          |
| 2nd quarter                | 3,665                 | 18,066 | 18,420  | 6,367    | 7,279  | 53,922              | 2,499          |
| 3rd quarter                | 3,211                 | 17,665 | 18,168  | 6,417    | 6,903  | 52,480              | 2,212          |
| 4th quarter                | 4,263                 | 20,496 | 21,423  | 7,927    | 8,341  | 62,596              | 1,887          |
| TOTAL                      | 15,185                | 76,161 | 78,859  | 28,514   | 30,441 | 229,692             | 7,936          |
| 5—yr Av. 1969—73           | 14,175                | 72,555 | 73,907  | 26,189   | 28,537 | 215,827             | 6,009          |
| 5—yr Av. 1964—68           | 8,928                 | 55,605 | 53,294  | 16,336   | 20,890 | 155,346             | 333            |

<sup>a</sup>Includes Yukon and Northwest Territories.

Source: Canadian Statistical Review, Catalogue No. 11-595 and 11-003, Statistics Canada.

Financial projections indicate that to recover increased costs Ontario Hydro will need to increase its rates by 31.9 percent in 1977 followed by increases of 11.7 percent and 10.5 percent in 1978 and 1979. Hydro Quebec proposes an increase of 9.9 percent in 1977 and 17 percent for each year through to 1980.

In discussing the electricity situation a year ago it was stated that the electricity supply outlook was favorable provided the utilities obtained adequate revenues for expansion. The position has deteriorated in some provinces as a result of capital expenditure restrictions imposed by several

provinces including Ontario and Quebec. The effects of these restrictions will not be noticeable for several years because a long construction time is required for major capital facilities, but they will depend on (a) increased future demand, (b) price increases, (c) conservation measures, and (d) the availability of alternative energy sources.

### Canadian Energy Policies

In the summer of 1976 the Minister of Energy, Mines and Resources published a policy document *An Energy Strategy for Canada: Policies for Self-Reliance*. This document examines Canada's energy situation and outlook for the medium term (15 years).

The main features of Canada's medium-term energy prospects are as follows:

- At current domestic price levels, even after allowing for inflation, the gap between demands for energy and domestic availability will increase. Oil sands development, frontier oil and gas would not be economically feasible and net oil imports could amount to 72 percent of demand by 1990.
- At domestic energy prices in the range of current international oil prices, Canada might regain a position by the late 1980s where net domestic availability of energy exceeds domestic demands.
- The provision of additional domestic energy supplies will require \$180 billion worth of men and materials (at 1975 prices). This could put a strain on labor and capital markets.
- The balance of trade in oil could swing from a surplus of \$1 billion in 1974 to a deficit of over \$5 billion by 1985 (in 1975 dollars).
- In addition to worsening Canadian energy supply/demand problems, a continuation of current prices could lead to a substantial deficit in the Oil Import Compensation Fund.
- The necessity of moving domestic oil prices towards international levels conflicts with the Anti-Inflation Program and will impose additional costs on Canadians.
- In summary, the medium-term supply/demand situation for energy poses serious potential problems that could adversely affect domestic economic performance and living standards over the next 15 years.

The government's current national energy strategy has as its overall objective the achievement of energy self-reliance within 10 years. (Self-reliance in energy can be measured by the degree to which Canada is independent of imported oil from sources where continuity of supply is not assured.) The policy thrusts to be pursued in support of this objective include:

- appropriate energy pricing
- energy conservation
- increased resource information flow
- increased exploration and development
- interfuel substitutions
- new delivery systems
- emergency preparedness

- increased research and development
- greater Canadian content and participation.

The government has adopted a number of targets in the context of its energy strategy:

- Moving domestic oil prices within the next two to four years to international oil price levels or to a price adequate to bring forth additional Canadian production, whichever is lower.
- Moving domestic prices for natural gas to an appropriate competitive relationship with oil over the same time period.
- Reducing the average rate of growth in energy use in Canada over the next 15 years to less than 3.5 percent a year. This will be achieved by competitive pricing measures and energy conservation initiatives.
- Maintaining self-reliance in natural gas until northern resources can be brought to market under acceptable conditions, for example, in regard to the environmental and social impact of northern pipeline development and the anticipated cost of northern gas resources.
- Doubling exploration and development activity in the frontier regions of Canada over the next three years.
- Reducing the absolute level of oil imports to Canada in 1985 to less than 800,000 barrels per day.

### **Implications of Energy Policies for Canadian Agriculture**

As outlined below, this policy has important implications for agriculture:

- Higher energy prices will have an impact, other things being equal, on costs of production and net farm incomes. These impacts will vary with the type of farm and region. The impact will be felt in two ways – directly through higher prices for energy directly consumed on farms, and indirectly through energy-related price increases for purchased inputs, e.g., fertilizers, and indirectly, again, through production adjustments.
- Higher energy prices could also affect the competitiveness of Canadian agricultural products in export markets, e.g., the competitiveness of Canada's grain exports vis-a-vis U.S. exports. Farmers are already partly protected against higher energy prices (purple gasoline, excise tax rebates).
- If Canadian energy prices had risen to world levels on July 1, 1976 (i.e., from \$8/bb to \$13.50/bb) the estimated impact would have been a 50-percent

increase in the farm price of petroleum products and a 2.5-percent increase in fertilizer prices.

- Certain sub-sectors of Canadian agriculture that are intensive energy users (e.g., greenhouse producers) could face severe adjustment problems during periods of rising energy prices and supply uncertainties.
- There are constraints on interfuel substitution possibilities in agriculture, at least in the short run. While some producers can switch energy sources fairly readily (e.g., from natural gas to oil in greenhouse production and perhaps crop drying), for others the substitution possibilities are not at all easy. The prime example is the energy used in field operations.

### Energy Outlook for Canadian Agriculture

From the world point of view, the outlook is for a more deliberate, multilateral approach to crude oil pricing by the OPEC countries. The immediate outlook is for a 10- to 15-percent price increase in early 1977. For Canada, a 3-cents-per-gallon increase in gasoline, diesel fuel, and heating fuel prices is expected in early 1977. As world prices for crude oil increase, there will be an increasing tendency for domestic crude oil prices and, hence, refined product prices to follow. With a policy target of raising domestic prices to world levels this means that domestic prices must rise faster than the foreign prices if the target is to be met.

The cost of electricity to farmers will increase, especially if regulatory agencies approve rate increases so that capital construction can keep pace with developing consumer demands. If sufficient rate increases are not approved, then some forms of electrical uses will probably be increasingly curtailed beginning eight to ten years hence. Whether agricultural uses of electricity are curtailed is a matter of policy yet to be decided.

For the next crop year the outlook is for sufficient energy supplies, but at the already projected price increases. There is little to indicate that energy supplies will be of major concern for Canadian farmers in their 1977 operations.

### REFERENCES

1. Monthly Energy Review, Federal Energy Administration, National Energy Information Center, Washington, D.C.
2. Energy Report from Chase. Energy Economics Division, Chase Manhattan Bank, New York, N.Y. June 1976.
3. An Energy Strategy for Canada, Policies for Self-Reliance. Minister of Energy, Mines and Resources, Energy Policy Sector, Department of Energy, Mines and Resources, Ottawa, Canada. 1976.
4. International Oil and Gas Digest. International Oil and Gas Section, Energy Development Sector, Department of Energy, Mines and Resources, Ottawa, Canada. Volume 5, May 1 – June 30, 1976. This publication has a restricted circulation and is not generally available to the public.
5. "Saudi Shift", The Economist, Volume 260, No. 6937, London, August 14, 1976.
6. "Energy: Emerging Issues in Presidential Campaign". U.S. News and World Report. October 4, 1976. pp. 33 – 38.
7. "We should Have Started Yesterday". By George C. McGee. U.S. News & World Report. October 4, 1976. pp. 38–39.
8. "1975 Situation and Outlook for Energy", Canadian Farm Economics. Economics Branch, Agriculture Canada, Ottawa. Volume 10, No. 6, December, 1975. pp. 30–45.

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# FARM LABOR



*Total employment in farming appears to have fallen in Canada in 1976 after two consecutive years of increase. Prospects of lower farm incomes are likely to result in a further decline in farm labor in 1977. This, coupled with an adequate supply of seasonal workers, will prevent wages from increasing more than 10 percent.*



*R.S. Rust and W.D. Jones\**

## INTRODUCTION

The Canadian farm labor market is characterized by declining employment and rapidly increasing wages (Figures 1 and 2). The trends are common to all regions.

Average annual employment in farming during the 1964–68 period was estimated at 575 thousand persons, of which 5.6 percent were in the Atlantic region, 19.8 percent in Quebec, 25.7 percent in Ontario, 44.5 percent in the Prairie region and 4.2 percent in British Columbia (Table 1). Farm operators represented 61 percent of farm employment while unpaid family workers and paid workers accounted for 21.6 percent and 17.4 percent respectively (Table 2). The average farm wage rate in Canada for the period was \$1.08 per hour with board and \$1.26 per hour without board (Table 3). Wages were lowest in the Maritime Provinces at \$.91 per hour and \$134 per month with board or \$1.01 per hour and \$177 per month without board. British Columbia had the highest wages at \$1.28 per hour and \$196 per month with board or \$1.42 per hour and \$268 per month without board.

Over the five-year period 1969–73 the estimated average annual employment in farming was 501 thousand

persons, a decrease of 74 thousand from the 1964–68 period. In absolute terms, the largest decline occurred in the Prairie region (28 thousand) while more moderate declines occurred in Ontario (20 thousand), Quebec (15 thousand), and the Atlantic region (9 thousand). British Columbia had a decrease of only 1 thousand. Despite the large variation in the magnitude of changes, the distribution of the total farm labor force among the regions did not alter significantly. Farm operators, however, are estimated to have decreased to 57.7 percent of total farm employment while hired labor increased to 19.6 percent of the total. Unpaid family labor remained relatively constant at 22.8 percent. Average farm wages in Canada increased over 35 percent to \$1.44 per hour and \$264 per month with board, or to \$1.70 per hour and \$315 per month without board.

## REVIEW, 1973-75

By 1974 employment in farming had decreased to an estimated 473 thousand persons, 28 thousand below the average for the previous five-year period. Declines of 14 thousand in Quebec and 8 thousand in Ontario accounted for most of the change. British Columbia and the Prairie region both had a decrease of 2 thousand while in the Atlantic region farm employment decreased by 1 thousand persons. The hired labor component continued to increase relative to operator and unpaid family labor in 1974 despite an estimated increase in numbers of all components.

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## EMPLOYMENT IN AGRICULTURE BY REGION, 1951 TO 1975

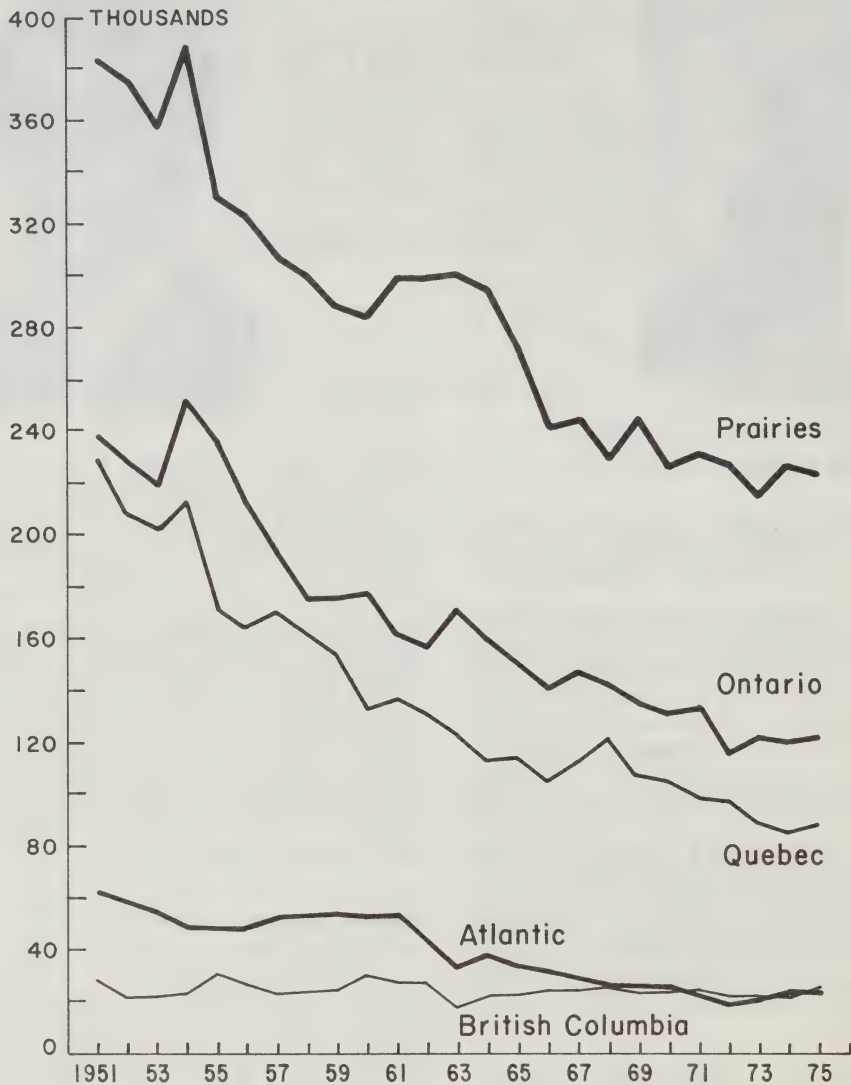


Figure 1

## AVERAGE HOURLY FARM WAGE OF MALE WORKERS IN CANADA

(May 15 each year)

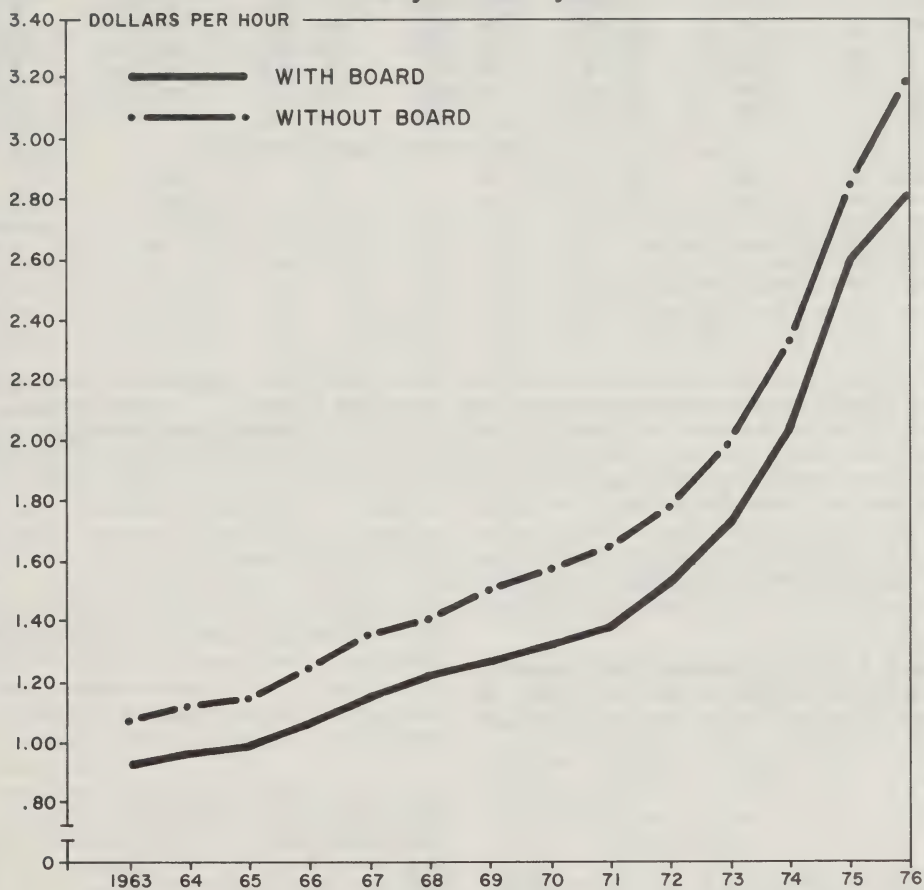


Figure 2

**TABLE 1. AVERAGE ANNUAL EMPLOYMENT IN CANADIAN AGRICULTURE BY REGION, 1964-68, 1969-73, 1974, 1975 AND 1976.**

| Year   | Canada | Atlantic region | Quebec     | Ontario    | Prairie region | British Columbia |
|--|--------|-----------------|------------|------------|----------------|------------------|
| — number in thousands with percent of total in brackets <sup>a</sup> — |        |                 |            |            |                |                  |
| 1964-68  | 575    | 32 (5.6)        | 114 (19.8) | 148 (25.7) | 256 (44.5)     | 24 (4.2)         |
| 1969-73  | 501    | 23 (4.6)        | 99 (19.8)  | 128 (25.5) | 228 (45.5)     | 23 (4.6)         |
| 1974   | 473    | 22 (4.7)        | 85 (17.9)  | 120 (25.4) | 226 (47.8)     | 21 (4.4)         |
| 1975   | 479    | 22 (4.6)        | 88 (18.4)  | 121 (25.3) | 223 (46.6)     | 25 (5.2)         |
| 1975 (RLFS)  | 486    | 24 (4.9)        | 70 (14.4)  | 118 (24.3) | 258 (53.1)     | 16 (3.3)         |
| 1976 <sup>b</sup>  | 469    | 22 (4.7)        | 72 (15.4)  | 109 (23.2) | 249 (53.1)     | 17 (3.6)         |
| average employment: January-September                                  |        |                 |            |            |                |                  |
| 1975 (RLFS)  | 494    | 23              | 72         | 121        | 261            | 17               |
| 1976 (RLFS)  | 475    | 20              | 74         | 112        | 251            | 18               |

<sup>a</sup>Data may not total because of roundings.

<sup>b</sup>Unofficial estimate.

Note: RLFS = Revised Labour Force Survey.

Source: Statistics Canada, The Labour Force, Catalogue No. 71-001 monthly.

In 1975 farm employment was higher than the 1974 total, which in turn was above the 1973 total. This reversal of the previous trend was a result of several factors. The higher farm incomes in 1973 and 1974 had encouraged operators of marginal farms to remain in agriculture and is believed to have increased the demand for paid labor on larger farms. Improved farm wages and a lack of non-farm employment opportunities increased the supply of paid and unpaid labor to farming. The estimated number of persons employed regionally in

farming in 1975 was 22 thousand in the Atlantic region, 88 thousand in Quebec, 121 thousand in Ontario, 223 thousand in the Prairie region and 25 thousand in British Columbia. The numbers of farm operators and unpaid family workers declined slightly to an estimated 270 thousand and 100 thousand respectively. Hired labor employment increased by an estimated 10 thousand persons to 109 thousand.

Farm wages increased at an average annual rate of more than 15 percent during the 1973-75 period and in 1975 resulted in farm wage expenditures reaching over \$520 million. Wages with board were estimated at \$2.60 per hour and \$443 per month; wages without board were estimated at \$2.86 per hour and \$491 per month.

**TABLE 2. AVERAGE ANNUAL EMPLOYMENT IN CANADIAN AGRICULTURE BY CLASS OF WORKER, 1964-68, 1969-73, 1974, 1975 AND 1976.**

| Year   | Total | Paid Workers | Unpaid Family Workers | Self-employed Operators |
|--|-------|--------------|-----------------------|-------------------------|
| — number in thousands with percent of total in brackets <sup>a</sup> — |       |              |                       |                         |
| 1964-68  | 575   | 100 (17.4)   | 124 (21.6)            | 350 (61.0)              |
| 1969-73  | 501   | 98 (19.6)    | 114 (22.8)            | 289 (57.7)              |
| 1974   | 473   | 99 (20.9)    | 103 (21.8)            | 271 (57.3)              |
| 1975   | 479   | 109 (22.8)   | 100 (20.9)            | 270 (56.4)              |
| 1975 (RLFS)  | 486   | 138 (28.4)   | 92 (18.9)             | 256 (52.7)              |
| 1976 <sup>b</sup>  | 469   | 141 (30.1)   | 90 (19.2)             | 238 (50.7)              |
| average employment: January-September                                  |       |              |                       |                         |
| 1975 (RLFS)  | 494   | 141          | 94                    | 259                     |
| 1976 (RLFS)  | 475   | 143          | 91                    | 241                     |

<sup>a</sup>Data may not total because of roundings.

<sup>b</sup>Unofficial estimate.

Note: RLFS = Revised Labour Force Survey.

Source: Statistics Canada, The Labour Force, Catalogue No. 71-001 monthly.

The relative importance of hired labor varies greatly by type of farm and to a lesser extent by size of farm, as indicated by a sample of 1973 taxfiler data (Table 4). Most noticeable are fruit and vegetable farms where hired labor represents about 23 percent of total farm expenditures. In addition, an estimated 75 percent of these farms employ some paid labor. Hog farms tend to operate with a minimum of hired labor and only 1.8 percent of their total farm expenses are attributed to salary and wage expenditures. Less than 45 percent of hog farms appear to use paid labor.

Large farms employ most of the hired labor while small farms depend extensively on family labor. The extent of this relationship is shown by the estimated proportion of farms reporting salary and wages disaggregated by farm size. While 74 percent of the largest farms employed

**TABLE 3. AVERAGE FARM WAGES IN CANADA OF MALE EMPLOYEES AS AT MAY 15, 1964-68, 1969-73, 1974, 1975 AND 1976.**

| Province <sup>a</sup> | With Board        |      |      |         |         | Without Board     |      |      |         |         |
|-----------------------|-------------------|------|------|---------|---------|-------------------|------|------|---------|---------|
|                       | 1976 <sup>b</sup> | 1975 | 1974 | 1969-73 | 1964-68 | 1976 <sup>b</sup> | 1975 | 1974 | 1969-73 | 1964-68 |
| — dollars per hour —  |                   |      |      |         |         |                   |      |      |         |         |
| Maritimes             | 2.54 ( 6.3)       | 2.39 | 1.78 | 1.21    | .91     | 2.72 (10.6)       | 2.46 | 2.03 | 1.41    | 1.01    |
| Quebec                | 2.41 ( 4.3)       | 2.31 | 1.70 | 1.21    | .94     | 2.91 (11.5)       | 2.61 | 2.10 | 1.51    | 1.12    |
| Ontario               | 2.71 ( 5.4)       | 2.57 | 2.11 | 1.55    | 1.10    | 3.14 (10.6)       | 2.84 | 2.33 | 1.80    | 1.29    |
| Manitoba              | 2.86 (13.9)       | 2.51 | 1.97 | 1.42    | 1.05    | 3.33 (21.1)       | 2.75 | 2.28 | 1.67    | 1.25    |
| Saskatchewan          | 2.98 (11.6)       | 2.67 | 2.06 | 1.41    | 1.12    | 3.51 (15.1)       | 3.05 | 2.40 | 1.66    | 1.32    |
| Alberta               | 3.09 ( 7.7)       | 2.87 | 2.18 | 1.50    | 1.14    | 3.40 (12.2)       | 3.03 | 2.53 | 1.76    | 1.37    |
| British Columbia      | 3.19 (11.1)       | 2.87 | 2.46 | 1.68    | 1.28    | 3.67 (12.2)       | 3.27 | 2.58 | 1.98    | 1.42    |
| Canada                | 2.79 ( 7.3)       | 2.60 | 2.06 | 1.44    | 1.08    | 3.21 (12.2)       | 2.86 | 2.33 | 1.70    | 1.26    |
| — dollars per month — |                   |      |      |         |         |                   |      |      |         |         |
| Maritimes             | 435 (19.2)        | 365  | 320  | 211     | 134     | 488 (15.6)        | 422  | 385  | 258     | 177     |
| Quebec                | 385 ( 7.5)        | 358  | 274  | 195     | 144     | 483 ( 2.3)        | 472  | 375  | 255     | 189     |
| Ontario               | 495 (11.5)        | 444  | 402  | 287     | 177     | 536 (12.4)        | 477  | 446  | 334     | 229     |
| Manitoba              | 498 ( 9.5)        | 455  | 359  | 260     | 178     | 600 (25.3)        | 479  | 416  | 314     | 223     |
| Saskatchewan          | 533 ( 9.7)        | 486  | 404  | 267     | 196     | 610 (11.5)        | 547  | 458  | 315     | 239     |
| Alberta               | 545 (15.2)        | 473  | 400  | 277     | 192     | 621 (17.4)        | 529  | 472  | 329     | 241     |
| British Columbia      | 585 (16.3)        | 503  | 427  | 312     | 196     | 657 (21.0)        | 543  | 533  | 362     | 268     |
| Canada                | 497 (12.2)        | 443  | 383  | 264     | 178     | 559 (13.8)        | 491  | 443  | 315     | 226     |

<sup>a</sup>Data for Newfoundland are not available.

<sup>b</sup>Data in brackets represent percentage change from the previous year's average at May 15.

Source: Statistics Canada, Farm Wages in Canada, Catalogue No. 21-002 occasional.

some labor, only 17.3 percent of the smallest farms required, and could afford, hired labor. The low average salary and wage expenditures per farm reporting labor costs indicate that most farms employ paid labor on a seasonal or part-time basis.

## SITUATION IN 1976

### Employment

In order to expand information on the Canadian labor force, a Revised Labor Force Survey (RLFS) was developed by Statistics Canada. The RLFS was introduced in 1976 although in 1975 it was run parallel to the former survey as a testing procedure. This article uses the RLFS employment estimates when comparing 1976 to the previous year with the understanding that some problems exist in the 1975 estimates.

Estimates of total farm employment for 1976 indicate a return to the traditional decline in farm labor after two consecutive years of increase. Employment from January to September was 19 thousand persons less than for the same nine months of 1975. By region, farm employment was down 3 thousand in the Atlantic region, 9 thousand in Ontario, and 10 thousand in the

Prairie region. Quebec and British Columbia had increases estimated at 2 thousand and 1 thousand persons respectively. Estimated employment of paid workers increased by 2 thousand persons for the first nine months but this was more than offset by a decrease in unpaid family labor of 3 thousand. The major change for 1976 was the RLFS estimate that indicated the average number of farm operators was down by 18 thousand. It is felt that this estimate is high, with the discrepancy possibly due to problems in the initiation of the new survey.

Last year's outlook stated that the number of paid workers would increase in 1976 while numbers of farm operators and unpaid family labor would stabilize or decline slightly. It was also projected that the increase in paid labor employment would more than compensate for any decreases in the other components and result in a net increase in farm employment. The predicted increase in farm employment that did not materialize appears to have been due to a slower than expected growth in paid labor employment and the surprising reported decline in the number of farm operators.

It appears that a number of farm operators, who had delayed leaving farming during the previous three years

**TABLE 4. ESTIMATES OF SALARY AND WAGE EXPENDITURES BY TYPE AND SIZE OF FARM, CANADA, TAXFILER DATA, 1973.**

|                           | Salary and Wage<br>Expenditures as a<br>Percent of Total<br>Farm Expenses <sup>a</sup> | Percent of<br>Farms Reporting<br>Salary and Wage<br>Expenditures | Average Salary and<br>Wage Expenditures<br>per Farm<br>Reporting |
|---------------------------|--|--|--|
|                           |  |  | — \$ —   |
| Type of Farm <sup>b</sup> |  |  |  |
| Dairy                     | 6.0  | 68.2   | 1,436  |
| All Livestock             | 2.7  | 45.9   | 1,104  |
| Cattle                    | 2.5  | 44.9   | 998  |
| Hogs                      | 1.8  | 44.3   | 1,186  |
| Poultry                   | 3.3  | 55.0   | 2,041  |
| All Crops                 | 8.8  | 44.4   | 1,625  |
| Grain                     | 5.2  | 39.5   | 843  |
| Fruits and Vegetables     | 23.2   | 75.4   | 3,217  |
| Other Crops               | 14.5   | 43.5   | 3,609  |
| Miscellaneous Specialty   | 12.5   | 40.2   | 2,979  |
| Mixed                     | 4.1  | 53.2   | 866  |
| Size of Farm <sup>c</sup> |  |  |  |
| < \$ 2,500                | 2.8  | 17.3   | 348  |
| \$ 2,500 — \$ 4,999       | 4.0  | 29.5   | 450  |
| \$ 5,000 — \$ 9,999       | 4.6  | 39.2   | 597  |
| \$10,000 — \$19,999       | 4.7  | 52.5   | 798  |
| \$20,000 >                | 5.6  | 74.0   | 2,296  |
| All Farms                 | 5.2  | 47.9   | 1,435  |

<sup>a</sup>Excludes capital cost allowance.

<sup>b</sup>Based on 51 percent or more of gross farm sales.

<sup>c</sup>Based on gross farm sales.

Source: Derived from Statistics Canada, unpublished taxfiler data, 1973.

Note: Estimates of salary and wage expenditures are based on a sample of 1973 taxfiler records reporting some self-employment farm income. The sample does not include incorporated farms.

because of increased farm incomes, quit in 1976. This fact plus a leveling-off of farm incomes in 1975 apparently reduced the further expansion of hired labor employment in farming.

With unfavorable farm income prospects for the remainder of 1976 and 1977 it is expected that 1976 farm employment will average out at about 469 thousand persons. Employment is expected to be 22 thousand in the Atlantic region, 72 thousand in Quebec, 109 thousand in Ontario, 249 thousand in the Prairie region, and 17 thousand in British Columbia. The number of farm operators in 1976 should average approximately 238 thousand, unpaid family workers 90 thousand, and paid workers 141 thousand.

## Wages

Farm wages continued to increase in 1976 but at a lower rate than in the previous two years, primarily because of the leveling-off of farm incomes in 1975 and unfavorable

prospects that developed in 1976. The wage increase was an estimated 11 percent from May, 1975 to May, 1976 compared with increases of close to 20 percent for the 1973–74 and 1974–75 periods. Farm wages without board, on an hourly and monthly basis, were: \$3.67 and \$657 in British Columbia; \$3.40 and \$621 in Alberta; \$3.51 and \$610 in Saskatchewan; \$3.33 and \$600 in Manitoba; \$3.14 and \$536 in Ontario; \$2.91 and \$483 in Quebec and \$2.72 and \$488 in the Maritime Provinces. Lower farm wages in Quebec and the Maritime Provinces are believed to largely reflect the relatively high rates of unemployment, which limited the number of non-farm job opportunities and reduced the pressure on farm operators to increase farm wages. British Columbia farm wage rates remained the highest in Canada. Wages in Manitoba showed the greatest relative improvement in 1976, bringing its rates more in line with those of the other western provinces.

The average farm wage in all provinces exceeded the legal minimum wage and in some cases the margin was

**TABLE 5. CANADA FARM LABOR POOL SYSTEM, EMPLOYMENT OPERATIONS, APRIL 1 TO JULY 31, 1975 AND 1976**

|                      | Employers' Orders |        | Orders Cancelled |       | Placements |        | Unfilled Vacancies |        |
|----------------------|-------------------|--------|------------------|-------|------------|--------|--------------------|--------|
|                      | 1976              | 1975   | 1976             | 1975  | 1976       | 1975   | 1976               | 1975   |
| British Columbia     | 4,314             | 2,572  | 683              | 304   | 2,579      | 1,560  | 1,052              | 708    |
| Alberta              | 5,374             | 3,841  | 373              | 324   | 4,401      | 2,923  | 600                | 594    |
| Saskatchewan         | 1,252             | 943    | 239              | 159   | 528        | 366    | 485                | 418    |
| Manitoba             | 2,438             | 2,854  | 374              | 503   | 1,608      | 1,453  | 456                | 898    |
| Ontario              | 20,520            | 20,959 | 2,375            | 3,888 | 11,164     | 9,771  | 6,981              | 7,300  |
| Quebec               | 6,985             | 1,862  | 906              | 237   | 5,400      | 783    | 679                | 842    |
| New Brunswick        | 166               | 171    | 58               | 37    | 84         | 67     | 24                 | 67     |
| Nova Scotia          | 509               | 219    | 18               | 20    | 425        | 125    | 66                 | 74     |
| Prince Edward Island | 1,328             | 1,692  | 273              | 291   | 629        | 964    | 426                | 437    |
| Canada               | 42,886            | 35,113 | 5,299            | 5,763 | 26,818     | 18,012 | 10,769             | 11,338 |

Source: Canada Farm Labour Pool System, Report on Employment Operations.

considerable despite the fact that in most provinces farm workers are excluded from minimum wage legislation.

In British Columbia and Alberta average farm wages (without board) were greater than the provincial minimum wage by \$.67 per hour and \$.60 per hour respectively. Moreover, there are indications that highly skilled farm workers capable of operating and repairing complex farm equipment may receive wages greatly in excess of the average farm rate.

### Canada Agricultural Manpower Programs

The Department of Manpower and Immigration operates a wide variety of programs designed to provide farmers with the quantity of labor required. The recruitment and placement activities of Canada Manpower Centres (CMC'S) relating to farm workers are gradually being reduced as the number of Canada Farm Labor Pools (CFLP's) expand. Six new permanent CFLP's opened in 1976 — one in British Columbia, one in Manitoba, and four in Quebec — bringing the total number of CFLP's to 65. In addition to the permanent CFLP's, 20 seasonal branch offices were operated this year in areas of heavy seasonal demand. The success of the CFLP's is indicated by the fact that employers' orders increased by 7,733, placements by 8,806, and unfilled vacancies decreased by 569 (Table 5). Local Agricultural Manpower Boards (LAMB's) establish guidelines on wage rates, working conditions and accommodation for hired workers and are responsible for much of the system's success.

The Canada Manpower Training Program and the Canada Manpower Industrial Training Program offered 166 types of agricultural courses during the 1975–76 fiscal year, representing a total of 365,717 training days. A total of 10,492 farm operators and farm workers

participated in full-time courses at an estimated cost to Canada of over \$9 million.

Federal-Provincial Agricultural Manpower agreements cover such matters as housing for seasonal workers, agricultural programs for youth, and agricultural manpower research. The Agriculture for Young Canadians (AYC) program, administered under the agreements, is designed to encourage Canadian youth to work on farms during the summer and to consider agriculture as a future occupation. Agreements expiring in 1978 have been signed with Prince Edward Island, Nova Scotia, New Brunswick, Ontario, and Saskatchewan. Similar agreements with Manitoba and British Columbia terminate in 1977. The agreement with Alberta expired in the 1975–76 fiscal year while an agreement with Quebec is pending. The Department of Manpower and Immigration's Mobility Program is now responsible for the movement and placement of farm workers, an activity previously cost-shared under the agreements.

Shortages in the supply of seasonal farm workers are alleviated by admitting a limited number of foreign workers into Canada under Foreign Seasonal Agricultural Workers Programs. These workers are under contract to a farmer for a specific length of time arranged prior to their entering Canada. Under the Caribbean Seasonal Workers Program over 5 thousand workers are admitted annually, most of whom work on fruit, vegetable, and tobacco farms in Ontario. About 500 Mexicans find employment in Quebec, Ontario, Manitoba and Alberta under the Mexican Seasonal Agricultural Workers Program. In 1976 the allotment of foreign students under the European Student Tobacco Workers in Ontario Program was reduced 50 percent to 670 because more Canadian workers were available. The

International Student and Youth Exchange Programs admit close to 750 agriculturists to work and train on farms across Canada. About 500 of these workers, mostly students, are employed in Western Canada. The Canada-United States Exchange Program, which allows Americans to work on Ontario tobacco farms, is becoming less significant as local workers gain expertise in harvesting tobacco. Only 277 tobacco specialists from the United States were required this year.

## REGIONAL SITUATION IN 1976

### British Columbia

The CFLP's were able to supply the farm labor required in British Columbia in spite of the fact that a late harvest coincided with the return of students to school. All areas reported a sufficient supply of labor with some areas reporting a surplus. Sufficient local workers were available in the Fraser Valley to harvest the berry crops. An innovative public telephone service providing information on the state of the crops and the demand for pickers proved very successful in the Lower Fraser Valley. Mechanical harvesters for sour cherries and grapes were partly responsible for the absence of labor shortages normally present in the Okanagan. Experienced dairy farm workers are still in short supply. Relief milkers find it difficult to maintain steady employment and permanent employment with a single farmer is preferred. Milker training courses are being offered to remedy the problem.

### Prairie Region

The supply of farm labor throughout the Prairie region appeared to be adequate in 1976 owing to the combined efforts of the CFLP's and the LAMB'S. Increased emphasis is being placed on the recruitment and training of local labor to meet needs. Alberta's Green Certificate Training Program is now well established with 80 trainees enrolled. Manitoba may institute a similar program. Both Saskatchewan and Manitoba have programs aimed at developing the native Indian population as a source of farm labor. Other areas of activity in the region include the possible development of labor standards for farm employment and the provision of labor-relation courses for farm operators and their employees.

### Ontario

The heavy demand for seasonal labor in Ontario usually surpasses the supply of local labor, and therefore requires the importation of foreign workers to provide additional labor. In 1976 a total of 6,812 foreign

workers were employed on a seasonal basis. Accommodation for 1,877 seasonal workers spread over 250 fruit, vegetable, and tobacco farms was improved for 1976 using grants totalling \$599,963. This expenditure was shared by the federal Department of Manpower and Immigration and the Ontario Ministry of Agriculture and Food. The province's AYC program placed 200 young people with non-farm backgrounds on commercial farms for a period of nine weeks during the summer. This was the third year of the program, which is considered a success by the farmers and youths involved.

### Quebec

The supply of seasonal workers for fruit crops was encouraged through daily transportation schemes and increased efforts to inform the public of farm employment opportunities. An adequate number of seasonal workers was available because of the good supply of student labor. The development of farm labor standards is progressing in Quebec with plans underway to have farm operators and workers covered by Workmen's Compensation in 1977. Also, a committee is investigating the possibility of removing the exemption of farm labor from minimum wage laws. Other steps have been initiated that could result in some prison inmates and welfare recipients supplying seasonal labor.

### Atlantic Region

On-the-job training is becoming the preferred method of training farm workers since it provides farmers with needed labor while giving the student valuable experience. The problem is that such training programs tend to be quite costly. In Prince Edward Island a New Farmer Program is teaching management and technical skills to candidates who are carefully screened. Prince Edward Island, Nova Scotia and New Brunswick continue to experience a shortage of skilled labor for full-time farm employment although mechanical harvesters and the U-Pick method have practically eliminated the shortages of harvest labor. At present, there is a shortage of persons to supervise U-pick harvesting. The practice of opening schools two weeks early and closing them during harvest allows students and farmers in New Brunswick to benefit from student employment during the potato harvest.

## OUTLOOK

Business investment in Canada is not expected to increase significantly in 1977 as there still appears to be considerable unused capacity. If industry's production

potential is more fully utilized in 1977, a slight increase in total employment could result. However, the rate of unemployment is expected to remain close to that of 1976 and the supply of farm labor should not change greatly.

The demand for permanent and full-season hired labor with farm training is likely to increase over the 1976–81 period as Canadian farms become more commercialized. Increases in farm wages will have to continue if farmers are to attract and retain skilled labor. The predicted adequate supply of casual farm workers for the next few years is expected to have a dampening effect on the rate of growth of average farm wage rates. Annual increases in average farm wage rates probably will not exceed 10 percent during 1976–81 unless farm incomes increase significantly. Monthly farm wage rates are expected to increase slightly faster than hourly farm wage rates based on the assumption that most permanent and full-season workers are paid on a monthly basis while most casual workers are paid on an hourly basis.

The economic prospects on many farms have fallen significantly during the past year and this is expected to reduce the number of farm operators and to a lesser extent the number of unpaid family workers in 1977. The demand for hired farm labor may weaken slightly. The increased world grain supplies and prospects of a much larger carry-over of wheat in the United States and Canada in 1977, combined with slightly lower prices for some coarse grains, much lower prices for wheat, and increased input costs have dampened the economic outlook on grain farms. The prospects for increased income on dairy and beef farms in 1977 are also quite limited. In addition, past high rates of increase in the price of farm land are not expected to continue. These conditions are expected to reduce the farm labor force to 455 thousand in 1977.

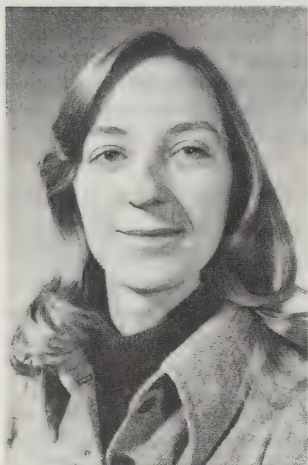
Farm employment is very unstable, with large year to year fluctuations. The supply and demand for farm labor

depend greatly on general economic conditions, farm incomes and new policy developments. In the long run however, the increases in farm labor productivity (resulting from technological change and substitution of capital for labor) and the consolidation of farms are expected to result in a net reduction in the number of persons employed in agriculture. An average decline in farm employment of 8 thousand persons per year is predicted over the 1976–81 period.

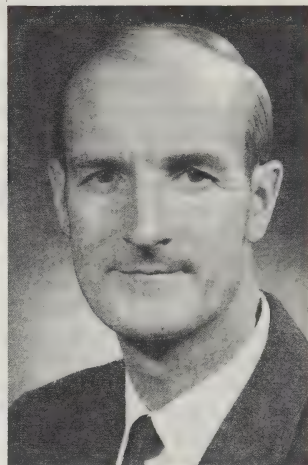
## REFERENCES

1. Rust, R.S., and W.D. Jones, "Agricultural Labor", Canadian Farm Economics, Vol. 10, No. 6, 1975.
2. Papers presented at the Canadian Agricultural Manpower Committee Annual Meeting, Toronto, September 14–16, 1976.
3. Retson, G.C., Situation and Outlook — Purchased Farm Inputs: Maritime Provinces, a paper presented at the Maritimes' Pre-Outlook Meeting, Moncton, October 15, 1976.
4. Montour, B., Farm Production Factors in Quebec: Outlook for 1976 and 1977, a paper presented at the Quebec Pre-Outlook Meeting, Montreal, October 13, 1976.
5. Fisher, G.A., Purchased Farm Inputs in Ontario: Trends and Outlook, a paper presented at the Ontario Pre-Outlook Meeting, Toronto, October 27, 1976.
6. Wiens, J.K., Purchased Operating Farm Inputs: Prairie Provinces, a paper presented at the Prairie Provinces Pre-Outlook Meeting, Regina, October 21, 1976.
7. Elgaard, K., Purchased Operating Farm Inputs: British Columbia, a paper presented at the British Columbia Pre-Outlook Meeting, Vancouver, October 22, 1976.

# AGRICULTURAL CHEMICALS AND OTHER SUPPLIES



*Supplies of agricultural chemicals in Canada will be sufficient to meet farmers' needs in 1977, with prices not expected to rise significantly. Baler twine supplies will be adequate, with prices in the range of \$12 to \$15 per 40-pound bale.*



*D.M. Shute and V.A. Heighton \**

## INTRODUCTION

Production of enough food to sustain the increasing world population has been a continuous challenge. Farmers have met this challenge through new farming practices such as increased specialization and technology, which in turn bring further need for control of biological forces that reduce productivity<sup>1</sup>.

The larger investments now necessary in farmland and machinery have discouraged pest control by cropping and tillage practices because of the economic need for continuous high crop yields. Farmers have become dependent on pesticides<sup>2</sup> for maintaining productivity and minimizing crop and livestock losses. Although agricultural chemicals represent only about 2 percent of farm operating expenses, their returns to farmers in terms of time and productivity have been very significant.

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<sup>1</sup> The Use of Pesticides and Herbicides in Alberta, Report and Recommendations, February 1976, Alberta Environment Conservation Authority.

<sup>2</sup> Pesticides include all agricultural chemicals.

## SITUATION: CHEMICALS

### World

World supplies of agricultural chemicals in 1975 were very tight with prices at high levels and factories working to capacity. A recession in the textile industry, however, eased the situation by reducing the demand for cotton, since its production usually accounts for about half of world pesticide consumption<sup>3</sup>. High prices for pesticides, particularly in developing countries, sharply curtailed demand in 1975. Although prices increased only slightly in 1976 and supplies of most pesticides were adequate, developing countries were still faced with a relatively high expenditure for pest control products.

### United States

The supply situation for pesticides in the United States in 1976 was generally favorable. As a result of increased production capacity and substantially larger inventory carry-overs, supplies were up 15 to 20 percent over 1975 levels. Production problems associated with raw material shortages and the energy crisis virtually disappeared in 1976.

Sales were slower in early 1976 as a result of this large supply. Farmers returned to the more normal practice of

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<sup>3</sup> Monthly Bulletin of Agricultural Economics and Statistics, F.A.O. Volume 25, May 1976.

**TABLE 1. VALUE OF SALES OF PEST CONTROL PRODUCTS, CANADA, AVERAGE 1964-68, 1969-73, and 1974-75. (Years ending September 30).**

| Year               | Total <sup>a</sup> | Herbicides <sup>b</sup> | Crops and Seed<br>Treatments | Livestock<br>Treatments <sup>c</sup> |
|--------------------|--------------------|-------------------------|------------------------------|--------------------------------------|
| — \$000 —          |                    |                         |                              |                                      |
| 1964-68            | 39,359             | 24,323                  | 10,647                       | 4,388                                |
| 1969-73            | 51,014             | 32,548                  | 14,716                       | 3,749 <sup>c</sup>                   |
| 1974               | 107,348            | 79,792                  | 24,667                       | 2,889 <sup>c</sup>                   |
| 1975 (preliminary) | 130,000            | 95,000                  | 27,000                       | 8,000 <sup>d</sup>                   |

<sup>a</sup>Excludes rodenticides and household and industrial insecticides.

<sup>b</sup>From 1949 to 1957 this category was called weedicides.

<sup>c</sup>Includes only livestock insecticides.

<sup>d</sup>Includes seed treatments.

Source: Statistics Canada, Sales of Pest Control Products by Canadian Registrants, Cat. No. 46-212, Annual.

purchasing pesticides when needed. U.S. distributors expected total sales for the 1976 season to be up 10 percent over 1975.

Suggested or list retail prices for selected pesticides were slightly higher (2 to 5 percent) in 1976 compared with the sharp increase of about 25 percent in the previous year.

## Canada

Value of sales of pest control products was up about 20 percent in 1975 from 1974 (Table 1). As nearly all agricultural chemicals are imported, the value of imports is a good indicator of pesticide use in Canada. Value of imports increased 39 percent from 1974 to 1975, down from a 48-percent increase from 1973 to 1974. While the quantity of imports increased 25 percent from 1973 to 1974, it increased only 5 percent from 1974 to 1975 (Table 2). With prices up only slightly in 1976 (2 to 5

percent) and increased crop acreage, pesticide use was expected to be above the 1975 level. The quantity of agricultural chemicals imported in the first half of 1976 was up 20 percent over the first half of 1975 while the value rose only 6 percent, with an average decrease in the reported unit value f.o.b. shipping point of 12 percent. A new federal regulation went into effect in March, 1976 requiring a person importing a pesticide for his own use to complete a declaration form, giving a detailed description of the product and its intended use. The previous regulation required much less information. Although this may have slowed the self-importation of agricultural chemicals, it did not discourage it completely and purchases in this manner increased slightly in 1976.

## OUTLOOK: CHEMICALS

### World

Shortages of agricultural chemicals and high prices have stimulated investment in new plants, but the supply and price outlook for developing countries is not likely to improve substantially in the near future. Much of the planned capacity is in exporting countries and is geared to the requirements of developed countries. Restrictive legislation making it more expensive to register pesticides will result in plants changing their product mix to concentrate on more profitable lines. Countries requiring pesticides for very specialized uses or for use on minor crops may find them in short supply.

### United States

Supplies are expected to be good for the 1977 crop season. Production capacity is expected to be up considerably — herbicide capacity 20 percent and insecticide capacity nearly 5 percent. New plants, spurred by anti-pollution standards are replacing old

**TABLE 2. IMPORTS INTO CANADA FROM ALL COUNTRIES OF AGRICULTURAL CHEMICALS BY VALUE AND QUANTITY, AVERAGE 1964-68, 1969-73 and 1974-75.**

| Year                  | Quantity   | Value*    | Unit Value |
|-----------------------|------------|-----------|------------|
|                       | — 000 lb — | — \$000 — | — \$ —     |
| 1964-68 average       | n.a.       | 19,309    | —          |
| 1969-73 average       | 88,457     | 36,891    | .42        |
| 1974                  | 157,532    | 79,664    | .51        |
| 1975                  | 166,108    | 110,688   | .67        |
| 1975 (first 6 months) | 100,107    | 69,547    | .69        |
| 1976 (first 6 months) | 120,086    | 73,403    | .61        |

\*f.o.b. = shipping point.

Source: Statistics Canada, Trade of Canada, Imports, Cat. No. 65-007.

**TABLE 3. EXPORTS OF AGRICULTURAL CHEMICALS TO ALL COUNTRIES 1973-75.**

| Year                  | Quantity     | Value*      | Unit Value |
|-----------------------|--------------|-------------|------------|
|                       | -- 000 lb -- | -- \$000 -- | -- \$ --   |
| 1973                  | 7,500        | 5,673       | .76        |
| 1974                  | 6,211        | 7,030       | 1.13       |
| 1975                  | 11,350       | 16,607      | 1.46       |
| 1975 (first 6 months) | 4,934        | 8,740       | 1.77       |
| 1976 (first 6 months) | 6,692        | 8,872       | 1.33       |

\*f.o.b. = shipping point.

Source: Statistics Canada, Trade of Canada, Imports, Cat. No. 65-007.

ones. While this will eventually lead to higher prices because of increased production costs, 1977 prices should be similar to 1976 levels, or only slightly higher.

Demand for pesticides for the remainder of the Seventies is expected to continue to increase, but at a slower rate than in the recent past. Pesticide regulatory activities and alternative pest control programs will become increasingly important in farmers' pest control efforts.

One of the most significant regulatory actions in the United States recently is the suspension of the production of chlordane and heptachlor for most uses by the Environment Protection Agency (EPA). However, the final fate of chlordane and heptachlor has not been determined. Cancellation proceedings are in progress with the possibility of a final decision by the end of the year.

In the future, the most significant regulatory requirements will be the final implementation of the U.S. Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), which was amended in 1972. All aspects of the Act are to be in force by October 1977. By this time, all private applicators must be certified and all pesticides registered before 1972 must be re-registered. If products fail to meet re-registration standards, cancellation notices must be issued by October 1977.

## Canada

Since Canada depends on the United States for most of its agricultural chemical supply, the U.S. supply situation and legislation affect Canada. The possibility of changes in Canadian patent laws and duty-free entry of agricultural chemicals to this country will continue to discourage the U.S. industry from establishing plants here.

Supply is expected to be sufficient for 1977 with no significant increase in prices. Any price increases will be associated with the higher cost of meeting pollution standards for plants and regulatory actions in both countries. Canada could be short of some pesticides for very specialized uses or for uses on minor crops if producers drop these small profit lines as a result of new registration expenses.

The health and environmental concerns for contentious pesticides are similar in Canada and the United States and thus regulatory actions or restrictions are alike. However, the Canadian system permits a more gradual change in direction than is possible in the United States.

The Federal Department of Consumer and Corporate Affairs released a working paper on possible revisions to the Canadian patent laws in June 1976. The proposed changes would reduce the length of patent exclusiveness from 17 years to 9 years.

Industry spokesman say that if a 9-year patent period is approved, testing and development requirements for agricultural chemical innovations would severely restrict product introduction into Canada and also that any change from the current patent regulations would be expensive and time consuming<sup>4</sup>.

## OTHER INPUTS

### Baler Twine and Wire

#### World

The supply problems associated with the production of sisal and henequen fibers in the early 1970s began to disappear in 1975. Reduced supplies in 1973 and rising prices in 1974 led farmers to stockpile twine. By the fall of 1975 there was a surplus.

The average price of twine in 1975 was more than two and one-half times the 1973 price. However, prices of twine began to decline in the spring of 1976 as the supply situation eased.

#### United States

Supplies of baler twine and wire were adequate for the 1976 hay crop, although imports and domestic produc-

<sup>4</sup>Hawkins, P.H., and J.H. Copeland. The Economic Impact of Proposed Changes in the Canadian Patent Act on Agriculture and the Economy, University of Alberta, October 1976.

**TABLE 4. CANADA: IMPORTS OF BALER TWINE, 1968-75.**

| Year                  | Quantity   | Value*    | Unit Value |
|-----------------------|------------|-----------|------------|
|                       | — 000 lb — | — \$000 — | — \$ —     |
| 1968                  | 45,975     | 5,407     | 11.76      |
| 1969                  | 37,524     | 4,215     | 11.23      |
| 1970                  | 46,999     | 5,201     | 11.07      |
| 1971                  | 80,360     | 8,372     | 10.41      |
| 1972                  | 88,419     | 10,160    | 11.49      |
| 1973                  | 86,990     | 13,366    | 15.36      |
| 1974                  | 112,902    | 49,628    | 43.96      |
| 1975                  | 77,935     | 45,006    | 57.75      |
| 1975 (first 6 months) | 71,129     | 40,968    | 57.60      |
| 1976 (first 6 months) | 36,691     | 10,008    | 27.37      |

\*f.o.b. shipping point.

Source: Statistics Canada, Trade of Canada, Imports, Cat. No. 65-007.

tion of twine and wire have declined sharply since last year. However, carry-over stocks of twine and wire were above normal and record stocks are expected. Imports of baler twine during the October 1975 – April 1976 period were almost 96 million pounds, down one half from the 192 million pounds imported a year earlier. Imports of baler twine represent about 80 percent of total U.S. requirements. Several baler twine manufacturers have temporarily curtailed production because of low orders for twine<sup>5</sup>.

U.S. retail prices of both wire and twine have fallen sharply since 1975. Natural fiber prices in 1976 were about \$12 to \$14 per 40-pound bale, down from \$30 to \$35 in April 1975. Synthetic twine was about \$1 to \$3 per bale less than natural twine. Baler twine and wire prices may strengthen a little in 1977 if natural fiber prices do not decline further and economic conditions both in the United States and abroad continue to improve.

## Canada

Baler twine supplies are more than adequate, with an average price per 40-pound bale at less than one-half of that of a year ago.

Canada imports about 90 percent of its baler twine requirements. The 10 percent manufactured domestically is synthetic twine. Imports come mainly from Mexico, Brazil, Tanzania and the United States. How-

ever, in 1975 Mexico supplied only 2 percent, whereas Belgium and Luxembourg contributed 17 percent. Imports for 1975 were about 78 million pounds, compared with 113 million in 1974. Canadian imports for the first six months of 1976 were down about 48 percent from the same period of 1975 (Table 1 and 2).

Price developments in the baler twine market revealed some drastic changes in 1976 compared with the situation a year earlier. The price of sisal twine in the June-September 1976 period ranged from \$11.00 to \$15.00 and averaged \$12.45 per 40-pound bale, down \$12.05 from a year ago. The average price of polypropylene was \$12.55 per bale, down \$10.20 from 1975. Three factors appear to have had a major impact on the price of twine in 1976:

1. the large carry-over stocks of both sisal and polypropylene from the 1975 season;
2. the worldwide surplus of capacity for manufacturing of both materials; and
3. the non-twine using techniques, such as more use of hay as silage and the increased use of such machines as jumbo balers, which use less twine.

In 1977 twine supplies should be ample with prices from \$12 to \$15 per 40-pound bale.

**TABLE 5. CANADA: IMPORTS OF BALER TWINE BY COUNTRY OF ORIGIN, SELECT YEARS, 1968-1974 AND 1975.**

| Country            | 1968                         | 1974  | 1975  |
|--------------------|------------------------------|-------|-------|
|                    | — percent of total imports — |       |       |
| Belgium-Luxembourg | 1.8                          | 5.6   | 16.6  |
| Brazil             | 3.0                          | 20.7  | 17.0  |
| Denmark            | 6.3                          | 0.4   | 0.9   |
| Mexico             | 19.2                         | 19.6  | 2.0   |
| Portugal           | 28.6                         | 0.5   | 3.5   |
| Tanzania           | 18.6                         | 14.6  | 5.6   |
| United Kingdom     | 1.9                          | 3.5   | 3.0   |
| United States      | 2.9                          | 16.1  | 16.5  |
| West Germany       | —                            | —     | 10.6  |
| Other*             | 17.7                         | 19.0  | 24.3  |
| Total              | 100.0                        | 100.0 | 100.0 |

\*Mainly Haiti, Ireland, Kenya and Mozambique.

Source: Statistics Canada, Trade of Canada, Imports, Cat. No. 65-007.

## Antifreeze

Supplies of antifreeze in Canada are adequate. The shortages that occurred in the early fall of 1973 and 1974 dissipated by the spring of 1975.

<sup>5</sup>U.S.D.A., E.R.S. Richard Smith, National Economic Analysis Division.

The Canadian market for antifreeze absorbs an estimated 14 million gallons a year. Dow Chemical of Canada Limited, Sarnia, Ontario, and Union Carbide of Canada Limited, Toronto, supply this requirement.

Ethylene glycol antifreeze was retailing from \$2.50 to \$3.00 per gallon in 1973, \$6.75 to \$9.00 in 1974 and \$6.00 to \$7.00 in 1975 and 1976. Some large retail outlets in a few major cities provided antifreeze for as low as \$5.00 per gallon as specials in September and October, 1976.

The supply of antifreeze in 1977 should be adequate and prices are expected to increase up to 10 percent.

## SUMMARY

In 1977, agricultural chemical supplies should be sufficient for farmers in both the United States and Canada as a result of increased production capacity in the United States and improved availability of raw materials. Legislation in the United States may result in some minor crop pesticides being in short supply and this is likely to affect Canada.

Prices are not expected to rise significantly, and any increases should be gradual and not of the magnitude of 1974 and 1975. The increased production costs associated with new plants and legislative requirements are partly offset by increased supplies.

Baler twine supplies will be adequate, with prices in the range of \$12 to \$15 per 40-pound bale.

Antifreeze will be in adequate supply with prices increasing up to 10 percent.

## REFERENCES

1. Evaluation of Pesticide Supplies and Demand for 1974, 1975 and 1976. Economic Research Service, U.S.D.A.
2. Statistics Canada, Farm Net Income, Cat. No. 21-002 and 21-004.
3. Statistics Canada, Sales of Pest Control Products by Canadian Registrants, Cat. No. 46-212.
4. Statistics Canada, Trade of Canada, Imports, Cat. No. 65-007.
5. United Nations, Food and Agriculture Organization, Monthly Bulletin, May, 1976.
6. Richard B. Smith, Supplies and Prices for Baling Wire and Twine, Marketing and Transportation Situation, ERS/U.S.D.A., Washington, D.C., 1976.
7. Unpublished internal memoranda of the United Co-operatives of Ontario and private discussion with officials of U.C.O.
8. Ritchie Feed and Seed, Ottawa, Ontario, private communication. Agricultural Prices and Indexes, Department of Agriculture, Alberta.

## ACKNOWLEDGEMENTS

The assistance of Mr. R.E. Houlton and Mr. W. Ormrod, Plant Products Division, Production and Marketing Branch, Agriculture Canada, is greatly appreciated by the authors.

# LEGISLATION

## ADVANCE PAYMENT FOR CROPS — Bill C-2

The first agricultural legislation of the second session of parliament was “an Act to Facilitate the Making of Advance Payments for Crops”. As Bill C-2, the Act was given first reading in the House of Commons on October 21 and second reading on the 29th. It was then referred to the House Committee on Agriculture for further discussion.

The Act provides for government guarantees on bank loans to eligible producer organizations on storable crops that have been produced. The government also pays the interest on these loans. Crops covered are all grains (excepting western wheat, oats and barley that come under the Canadian Wheat Board Act), oilseeds, root crops, fruits, and other field crops. The crop must be marketed through an organization that takes control of it — for example, provincial marketing boards operating an agency plan — before producers of the crop are eligible for advances. Advance payments might be provided to producers in one area and not to producers of the same crop in another area because their crop is not marketed through an eligible organization.

The advance allowed under the Act would be half the expected selling value of the crop, with a limit of \$15,000 to any one producer. Farm enterprises with more than one producer are eligible for an advance of \$30,000 if there are two partners in the unit and \$45,000 if there are three or more.

## AMENDMENTS TO CANADA GRAIN REGULATIONS

### Effective September 1, 1976.

Changes in the grain regulations made by the Canadian Grain Commission affect fees for the Commission's services, maximum tariffs at elevators, shrinkage allowance, abbreviations used in official documents, and certain administrative operations.

The fees for the Commission's services, listed in Schedule 1 of the amended regulations, were increased by an average of about 10 percent to compensate for increased costs of service. Increased costs of operating grain elevators were responsible for the revision of maximum tariffs to permit average increases of 10 percent for some services. Shrinkage allowance at elevators has been revised to prescribe allowance on the basis of a percentage of scale weight rather than by a fixed pound or bushel quantity per car as formerly was the case.

## GRAIN FUTURES ACT

### Regulations. Order in Council P.C. 1976-2626, October 28

The Grain Futures Act had not been amended since it was passed in 1939 until July 1976, when the new names of grain exchanges and clearance associations covered by the Act were written in to bring it up to date.

The new regulations, when they become law, will establish the method by which exchanges and clearing houses must register with the Canadian Grain Commission, the keeping of records by these bodies and their members, the inspection of their books and records, the making of enquiries under the Act, the making of representations to the Commission, publication of information and statistics relating to marketing of grain and transactions in grain futures, the obligations of clearing houses and exchanges toward the commission, etc.

Commodity clearing houses referred to in the Act under the new amendments are the Winnipeg Commodity Clearing Ltd., the British Columbia Grain Shippers' Clearance Association, and the Lake Shippers' Clearance Association. Exchanges written into the Act in the July amendments were the Winnipeg Grain Exchange and the Winnipeg Commodity Clearing Ltd.

# PROGRAMS AND POLICIES

## Dairy Program Adjustments

In October the government announced that the Market-Share Quota under the 1976-77 dairy program would be increased from 95 to 99 million hundredweight, with a subsidy of \$2.66 a hundredweight. The additional quotas were to be distributed within each province in such a way as to help producers who have been hardest hit by required changes in production levels. The Canadian Dairy Commission agreed with provincial agencies on the allocation of the additional quotas.

## Import Controls on Beef and Veal

Imports of beef and veal were placed under control of individual permits, effective midnight October 17. The government took this action in anticipation of disruptions in the Canadian market, following the U.S. decision to limit imports of beef and veal into that country. On October 19 the Minister of Agriculture and the Minister of Industry, Trade and Commerce jointly announced a quota system on beef and veal for the rest of 1976-77.

## New Crop Development Fund Projects

Over the next three years, the University of Manitoba will receive \$509,700 from Agriculture Canada's New Crop Development Fund to study production of fababeans and black beans. The project will examine soil requirements, field management, insect damage, pollination, nutrients, disease and weed control, and use of fababeans as rations for livestock and poultry.

## Producer Groups Assisted

Early in November, Agriculture Canada signed agreements for financial assistance with six producer

groups under the Fresh Fruit and Vegetable Storage Construction Financial Assistance Program. These groups receive assistance to build or renovate storage facilities.

## 1976 Crop Insurance Program

About 97,000 farmers participated in the Federal-Provincial Crop Insurance Program this year, and about \$62 million could be paid out in indemnities for crop damage, according to preliminary figures. Last year 94,000 farmers participated and indemnities paid out totalled about \$66 million.

## Conversion to Metric

Sales and purchases of grain will be expressed in metric as of February 1, 1977. Packaging of seeds is due to switch in time for spring planting. In the feed industry the changeover was scheduled to begin October 1.

## Stabilization Support for Western Potatoes

At the end of October the Minister of Agriculture announced that the western potato crop would be designed for support under the Agricultural Stabilization Act. Western growers of table potatoes are suffering from low prices. The Stabilization Program is expected to assure them of returns in line with costs of production.

## Sales of Agricultural Products Board

The Annual Report of the Agricultural Products Board records that the Board sold about \$8.3 million worth of fruit, egg products and beef last year to stabilize market prices for these commodities. The Board is empowered to buy, sell, import, store, transport and process agricultural products on behalf of the government.

## PUBLICATIONS

### ECONOMICS BRANCH, AGRICULTURE CANADA

*Available from the Publications Manager, Room 303, Sir John Carling Building, Ottawa, Ontario, K1A 0C5.*

**Policies and Programs for Agriculture: Federal.** Pub. No. 76/16

**Policies and Programs for Agriculture: Atlantic Provinces.** Pub. No. 76/13. Summaries of governmental programs of technical and financial assistance for farmers, information about assistance provided, persons or groups eligible, government agency responsible. To come: Ontario and Quebec.

### AGRICULTURE CANADA

*Available from the Information Division, Agriculture Canada, Ottawa, Ontario, K1A 0C7.*

**List of publications, 1977.** For farm and home. Cat. No. 5103.

**Metric and Grain Handling, 1976.** Folder. Cat. No. 1606.

### OTHER PUBLICATIONS

**European Community: The Facts.** History, institutions, agricultural policy, transportation, economic integration, energy, science, technology, political co-operation, etc. *Order from Commission of the European Communities, 350 Sparks Street, 11th floor, Ottawa, Ontario, K1R 7S8.*

**Federal Farm Credit Statistics** Based on statistics to the end of the fiscal year 1975. *Order from Farm Credit Corporation, Box 6309, Station J, Ottawa, Ontario, K2A 3W9.*

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## IN REPLY

Robert N. Plank, assistant branch manager of the Farm Credit Corporation in Kelowna, British Columbia, sent a detailed letter about the June article, "A Capital Budgeting Model for Evaluating Farm Real Estate Purchases". The author wrote this when he was on leave of absence from his teaching post at Ohio State University. Mr. Plank's letter has been sent to him there.

D.G. Kampouris of Ottawa, a systems consultant and part-time farmer writes that Canadian Farm Economics gives him "certain insights into the economics of farming". He says he has "a general interest in the performance of the agricultural sector in Canada, and occasionally C.F.E. has some interesting articles on that scale". Mr. Kampouris wrote to the authors of the June article, "Calculating Least-Cost Implement Sizes for Tillage and Seeding of Cereals". "My compliments," he writes, "for creating what appears to be a very useful product, and especially for the way you...have described the program and its functioning in clear terms."

Comments on recent issues have also been received from K.W. Clark, Plant Science Department, University of Manitoba; G.S. Colquhoun, district inspector, Prairie

region, Department of Consumer and Corporate Affairs; R.S. Butler, Western College of Veterinary Medicine, University of Saskatchewan; and R. McGiffin, farm management specialist, Ashern, Manitoba. The editor thanks all who have been taken the trouble to respond.

Anne McLean Bullen congratulated G. C. Retson on his analysis of livestock auction markets in the Maritime Provinces (CFE August). Mrs. Bullen wrote from Wye College in Kent, part of the University of London, where she does marketing research for the Centre for Agricultural Studies. "Mr. Retson's findings exactly parallel my own in the E.E.C.," she wrote, "in that this type of work shows clearly that if you tamper with one link in an interdependent chain eventually other links will adapt accordingly. This is why it is so difficult to predict how various policy measures will affect the 'marketing system'. The article also shows how currently fashionable marketing wisdom which may be valid for one country or area should not necessarily be superimposed on another area totally different in character, where the marketing system operating is an evolutionary response to a separate series of historical, geographical and other socio-economic factors."

"In the light of Mr. Retson's research I think one can ask a related question: how many of Agriculture Canada's 'marketing economists' have ever been to an auction, market, slaughterhouse, wholesale business, etc.? I have been to many, and now begin to understand why public policy rarely works out in practice as it is conceived in theory, at least in Europe. Marketing is not the poor cousin of economics; it is about people and trading relationships, not theory. The widening gulf between bureaucracy and the agricultural food chain is depressing."

Mrs. Bullen added that Claude Hill's article in the same issue on Canadian co-operatives was the first useful description she had seen on the subject. She made this suggestion: "It might be useful to have follow-up articles by the same authors dealing with further research on an identified problem, perhaps with a view to finding a practicable solution. I am reluctant to say that I sometimes get the impression that a great deal of research is purely theoretical and thus of limited use." These comments have been given to the author.

## ERRATUM

In the October 1976 issue, Volume 11, No. 5, page 30, second column, fourth paragraph, the three commissioners of the beef commission should read - Lydia Patry-Cullen, Hu Harries and Maxwell W. Mackenzie (Chairman).

IN REPLY TO AUTHORS AND EDITORS REGARDING DECEMBER 1976  
CANADIAN FARM ECONOMICS

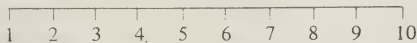
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# CONVERSION FACTORS FOR METRIC SYSTEM

| Imperial units         | Approximate<br>conversion factor     | Results in:                          |
|------------------------|--------------------------------------|--------------------------------------|
| <b>LINEAR</b>          |                                      |                                      |
| inch                   | x 25                                 | millimetre (mm)                      |
| foot                   | x 30                                 | centimetre (cm)                      |
| yard                   | x 0.9                                | metre (m)                            |
| mile                   | x 1.6                                | kilometre (km)                       |
| <b>AREA</b>            |                                      |                                      |
| square inch            | x 6.5                                | square centimetre (cm <sup>2</sup> ) |
| square foot            | x 0.09                               | square metre (m <sup>2</sup> )       |
| acre                   | x 0.40                               | hectare (ha)                         |
| <b>VOLUME</b>          |                                      |                                      |
| cubic inch             | x 16                                 | cubic centimetre (cm <sup>3</sup> )  |
| cubic foot             | x 28                                 | cubic decimetre (dm <sup>3</sup> )   |
| cubic yard             | x 0.8                                | cubic metre (m <sup>3</sup> )        |
| fluid ounce            | x 28                                 | millilitre (ml)                      |
| pint                   | x 0.57                               | litre (ℓ)                            |
| quart                  | x 1.1                                | litre (ℓ)                            |
| gallon                 | x 4.5                                | litre (ℓ)                            |
| <b>WEIGHT</b>          |                                      |                                      |
| ounce                  | x 28                                 | gram (g)                             |
| pound                  | x 0.45                               | kilogram (kg)                        |
| short ton (2000 lb)    | x 0.9                                | tonne (t)                            |
| <b>TEMPERATURE</b>     |                                      |                                      |
| degrees Fahrenheit     | (° F-32) x 0.56<br>or (° F-32) x 5/9 | degrees Celsius (° C)                |
| <b>PRESSURE</b>        |                                      |                                      |
| pounds per square inch | x 6.9                                | kilopascal (kPa)                     |
| <b>POWER</b>           |                                      |                                      |
| horsepower             | x 746<br>x 0.75                      | watt (W)<br>kilowatt (kW)            |
| <b>SPEED</b>           |                                      |                                      |
| feet per second        | x 0.30                               | metres per second (m/s)              |
| miles per hour         | x 1.6                                | kilometres per hour (km/h)           |
| <b>AGRICULTURE</b>     |                                      |                                      |
| gallons per acre       | x 11.23                              | litres per hectare (ℓ/ha)            |
| quarts per acre        | x 2.8                                | litres per hectare (ℓ/ha)            |
| pints per acre         | x 1.4                                | litres per hectare (ℓ/ha)            |
| fluid ounces per acre  | x 70                                 | millilitres per hectare (ml/ha)      |
| tons per acre          | x 2.24                               | tonnes per hectare (t/ha)            |
| pounds per acre        | x 1.12                               | kilograms per hectare (kg/ha)        |
| ounces per acre        | x 70                                 | grams per hectare (g/ha)             |
| plants per acre        | x 2.47                               | plants per hectare (plants/ha)       |

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VOLUME 12

NUMBER 1

FEBRUARY 1977

# CANADIAN FARM ECONOMICS

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Nova Scotia

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Agriculture  
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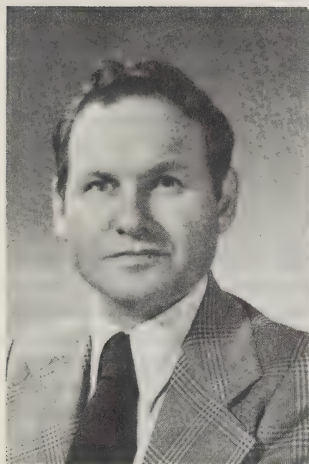
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**Letters from readers:** Letters are encouraged and should be addressed to the author or the Managing Editor. Responses...comments, suggestions and points of view are important for effective two-way communications. Letters may be used in the following issue of CFE and will be edited prior to publication where necessary.

# ECONOMICS OF HOG FEEDING ENTERPRISES IN NOVA SCOTIA



*A 10-year (1966-75) study of seven hog feeding enterprises showed total receipts per hog marketed ranged from a low of \$40.57 in 1971 to a high of \$116.06 in 1975. Returns to labor were correspondingly lowest in 1971 (-\$.99) and highest in 1975 (\$23.35). During the period feed efficiency and hog quality improved and hog numbers in the province increased significantly.*

*T. Campbell Gunn\**

## INTRODUCTION

In 1962 a study of 19 feeder hog enterprises was conducted in Nova Scotia and New Brunswick by the Economics Branch, Agriculture Canada, Truro. Continuation of this project was requested by the Nova Scotia Department of Agriculture and Marketing. Since 1965 data have been secured semi-annually from seven feeder hog operations in Nova Scotia.

For the study an effort was made to select farms that could be readily duplicated in most parts of Nova Scotia. On none of the farms were hogs the sole enterprise. Other enterprises included dairy, beef, vegetables, apples and grain.

This article gives some background to the hog industry in Nova Scotia and analyzes the factors influencing costs and returns from seven feeder hog enterprises in the last ten years. Returns are calculated on the basis of returns to all labor, including hired labor. This is done because of the difficulty involved in separating operator labor from hired labor and the difficulty, on mixed farms, in isolating the amount of labor spent on the hog enter-

prise. In addition farmers, like other businessmen, are interested in knowing the returns to labor.

## HOG INDUSTRY IN NOVA SCOTIA

In the early 1950s the hog industry was rather small. The total number of hogs on farms June 1, 1955 was 36,000 and hog sales accounted for 4.5 percent of total farm cash receipts. The construction of a co-operative abattoir in 1960 was accompanied by emphasis on hog production by the Nova Scotia Department of Agriculture and farm organizations. The number of hogs increased 94 percent from the 1955 level to 70,000 in 1975 when hog sales accounted for 10.9 percent of total farm cash receipts. Hog numbers for Canada as a whole decreased 10 percent during the period (Table 1). The main Nova Scotia production increases came in the late fifties and continued until the late sixties when production levelled off. The peak inventory year was 1971 when hog numbers reached 79,765.

In 1975, commercial marketings totalled 106,954 hogs. These were produced by 623 operators, 91 percent of whom marketed under 500 hogs annually (Table 2). Of the 58 producers marketing 500 or more hogs per year, approximately 15 were feeder hog as opposed to farrow-to-finish producers.

---

\*T. Campbell Gunn is an economist in the Economics Branch regional office in Truro, Nova Scotia.

**TABLE 1. TOTAL NUMBER OF HOGS ON FARMS  
JUNE 1, 1955-1975**

| Year | Nova Scotia | Canada    |
|------|-------------|-----------|
| 1955 | 36,000      | 5,284,000 |
| 1956 | 32,670      | 6,564,000 |
| 1957 | 31,000      | 7,022,000 |
| 1958 | 36,000      | 6,995,000 |
| 1959 | 49,000      | 7,624,000 |
| 1960 | 49,000      | 7,113,000 |
| 1961 | 46,856      | 5,809,000 |
| 1962 | 50,000      | 5,771,000 |
| 1963 | 53,000      | 6,070,000 |
| 1964 | 53,000      | 5,401,000 |
| 1965 | 57,000      | 5,147,000 |
| 1966 | 57,499      | 5,667,000 |
| 1967 | 65,000      | 5,211,000 |
| 1968 | 70,000      | 4,981,000 |
| 1969 | 72,000      | 5,331,000 |
| 1970 | 74,000      | 5,070,000 |
| 1971 | 79,765      | 6,519,000 |
| 1972 | 72,000      | 5,931,000 |
| 1973 | 71,000      | 4,758,000 |
| 1974 | 75,000      | 4,731,000 |
| 1975 | 70,000      | 4,800,000 |

Source: Statistics Canada, Cat. #23-203, Annual Livestock and Animal Products Statistics.

**TABLE 2. DISTRIBUTION OF HOG PRODUCERS BY  
NUMBER OF HOGS MARKETED, 1975**

| Number of Hogs Marketed | Number of Operators |
|-------------------------|---------------------|
| Under 10                | 337                 |
| 10 - 49                 | 138                 |
| 50 - 99                 | 33                  |
| 100 - 499               | 57                  |
| 500 - 999               | 28                  |
| 1000 - 1999             | 20                  |
| Over 2000               | 10                  |

Source: Don Cox, Supervisor of Swine Production, Nova Scotia Department of Agriculture and Marketing.

Hogs in Nova Scotia have been marketed through the Nova Scotia Hog Marketing Board since 1953.

## HOG RECEIPTS

Total receipts per hog marketed ranged from a low of \$40.57 in 1971 to a high of \$116.06 in 1975, a spread of \$75.49 (Table 3). In 1969, producers experienced the highest receipts per hog marketed of any year between 1966 and 1971. This was also the year of the lowest feed costs per hog marketed of any year studied. These events were followed by low hog prices in the following two years, as shown in the data. 1971 was the only year of

the 10 years under study in which there was no return to operator or hired labor. The farmer price received per hog marketed fluctuated within a range of \$75.49 during the 10 years studied. Labor returns per hog marketed fluctuated within a range of \$24.34 (Figure 1).

Government quality premiums show a marked decline beginning in 1972 because of a change in government policy rather than a change in hog quality. Federal premiums were not paid in 1972 and subsequent years and the provincial premium was less than the combination of federal and provincial premiums paid prior to 1972.

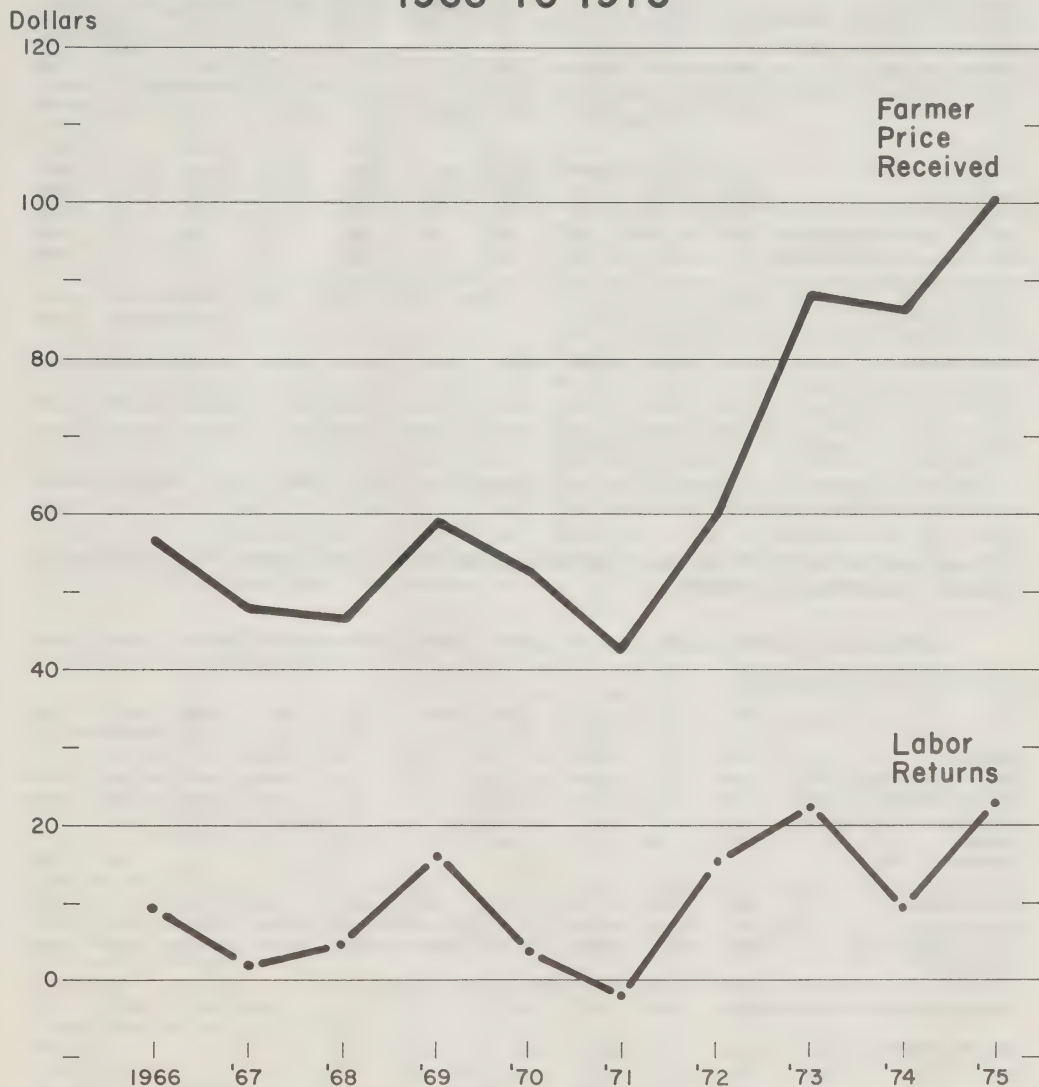
## HOG EXPENSES

Feed and weanling pigs were consistently the major items in hog enterprise expenses over the 10-year period (Table 4). In 1966, they accounted for 93 percent of all expenses, while in 1975 they represented 91 percent. The remaining items were marketing costs, veterinary fees, utilities, depreciation, interest on investment and miscellaneous charges. Total expenses per hog marketed ranged from \$41.64 in 1968 to \$87.63 in 1975, a range of \$45.99. Major increases came after 1972 when expenses increased from \$44.55 to \$87.63, or 96.7 percent. This was mainly due to increases in feed and weanling pig prices. In Table 4, no charge has been made for labor, most of which was provided by the farm operator. Accordingly, hog labor returns indicated below represent return to labor for time spent on the hog enterprise.

## Hog Labor Returns

Over the 10-year period, there was considerable variability in labor returns mainly because of hog price fluctuations (Figure 1). Returns varied from \$23.35 per hog marketed to -\$99, a spread of \$24.35. Income instability led to the introduction in 1974 of the Nova Scotia Hog Stabilization Plan, a joint province-producer funded program featuring individual stabilization accounts. Cash costs of production are covered in the program. The price received for hogs is set in a North American context as in general are the prices paid for inputs for pork production. Since virtually none of the pork-producing units are land based, there is a very strong reliance on imported grains. Because of the influence of the outside market forces and the subsequent lack of flexibility, the stabilization plan has been popular. Thirty-six percent of the producers, accounting for 85 percent of the production, were enrolled in the program in 1975.

# FARMER PRICE RECEIVED<sup>1/</sup> AND LABOR RETURNS PER HOG MARKETED IN NOVA SCOTIA 1966 TO 1975



<sup>1/</sup> Includes Stabilization, Local Sales and Government Assistance.

Source: Survey of Seven Feeder Hog Operators, by years, conducted by Atlantic Regional Office, Economics Branch, Agriculture Canada, Truro, Nova Scotia

Figure 1

**TABLE 3. AVERAGE RECEIPTS AND EXPENSES PER HOG MARKETING OF SEVEN FEEDER HOG OPERATIONS IN NOVA SCOTIA 1966-1975.**

| Item                               | 1966  | 1967  | 1968  | 1969  | 1970  | 1971  | 1972  | 1973  | 1974  | 1975   |
|------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| Receipts:                          |       |       |       |       |       |       |       |       |       |        |
| Sales of Market Hogs               | 53.70 | 45.64 | 44.93 | 57.22 | 52.09 | 41.70 | 58.85 | 87.88 | 83.61 | 109.28 |
| Government Premiums                | 2.38  | 2.40  | 1.57  | 1.26  | 1.08  | 1.16  | .77   | .53   | .70   | .78    |
| Provincial Stabilization Fund      |       |       |       |       |       |       |       |       | 3.13  | .92    |
| Inventory Change                   | 2.59  | .41   | 1.46  | 2.49  | -.54  | -2.29 | 4.27  | 8.92  | 3.39  | 5.08   |
| Total Receipts                     | 58.67 | 48.45 | 47.96 | 60.97 | 52.63 | 40.57 | 63.89 | 97.33 | 90.83 | 116.06 |
| Expenses:                          |       |       |       |       |       |       |       |       |       |        |
| Feed                               | 28.97 | 28.19 | 24.41 | 24.00 | 26.62 | 25.51 | 25.94 | 42.62 | 46.82 | 49.31  |
| Weanling Pigs                      | 16.99 | 14.99 | 15.20 | 17.09 | 17.58 | 11.90 | 18.83 | 27.89 | 29.10 | 34.90  |
| Marketing                          | .96   | .99   | .92   | .87   | .98   | .96   | 1.13  | 1.31  | 1.43  | 1.54   |
| Vet, Utilities & Miscellaneous     | .85   | .57   | .69   | .67   | .79   | .81   | .56   | .47   | .71   | .93    |
| Use of Equipment and Buildings     | .84   | 1.10  | 1.35  | 1.53  | 2.09  | 1.82  | 1.74  | 1.69  | 2.07  | 2.68   |
| Interest on Investment & Livestock | .54   | .54   | .53   | .86   | .90   | .56   | .64   | 1.01  | 1.42  | 1.51   |
| Stabilization Fund                 |       |       |       |       |       |       |       |       | .16   | 1.82   |
| Total Expenses                     | 49.16 | 46.36 | 43.09 | 45.01 | 49.04 | 41.56 | 48.83 | 75.00 | 81.70 | 92.71  |
| Hog Labor Returns <sup>a</sup>     | 9.51  | 2.10  | 4.87  | 15.96 | 3.60  | -0.99 | 15.06 | 22.33 | 9.13  | 23.35  |

<sup>a</sup>Note: Labor returns mean returns to all labor including hired.

Source: Survey of Seven Feeder Hog Operators by years conducted by Atlantic Regional Office, Economics Branch, Agriculture Canada, Truro, Nova Scotia.

**TABLE 4. DISTRIBUTION OF EXPENSES FOR PRODUCING FEEDER HOGS IN NOVA SCOTIA ON SEVEN FEEDER HOG OPERATIONS, 1966-1975.**

| Item  | 1966  | 1967  | 1968  | 1969  | 1970  | 1971  | 1972  | 1973  | 1974  | 1975  |
|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Per Cent of Total Expenses Spent On               |       |       |       |       |       |       |       |       |       |       |
| Feed  | 58.9  | 60.8  | 56.6  | 53.3  | 54.4  | 61.4  | 53.1  | 56.8  | 57.3  | 53.2  |
| Weanling Pigs                                     | 34.6  | 32.3  | 35.3  | 38.0  | 35.9  | 28.6  | 38.6  | 37.2  | 35.6  | 37.7  |
| Marketing   | 1.95  | 2.1   | 2.1   | 1.9   | 2.0   | 2.3   | 2.3   | 1.7   | 1.8   | 1.7   |
| Vet, Utilities & Miscellaneous                    | 1.70  | 1.2   | 1.6   | 1.5   | 1.6   | 2.0   | 1.1   | .6    | .9    | 1.0   |
| Use of Building & Equipment                       | 1.70  | 2.4   | 3.1   | 3.4   | 4.3   | 4.4   | 3.6   | 2.3   | 2.5   | 2.9   |
| Interest on Investment & Livestock                | 1.10  | 1.2   | 1.2   | 1.9   | 1.8   | 1.3   | 1.3   | 1.4   | 1.7   | 1.6   |
| Stabilization Fund                                |       |       |       |       |       |       |       |       | .2    | 2.0   |
| Total (Per Cent)                                  | 100   | 100   | 100   | 100   | 100   | 100   | 100   | 100   | 100   | 100   |
| Total Expenses Per Hog Marketed (\$) <sup>a</sup> | 46.57 | 45.96 | 41.64 | 42.52 | 49.49 | 43.86 | 44.55 | 66.07 | 74.63 | 87.63 |

<sup>a</sup>Expenses adjusted for inventory change.

Source: Same as Table 3.

## FACTORS AFFECTING LABOR RETURNS

### Feed and Weanling Pigs

With feed and weanling pigs representing over 90 percent of production expenses, much of the variation in hog

labor returns is caused by variations in prices of these items. Management practices are, therefore, directed mainly at improving hog quality and in reducing the amount and cost of feed required. Producers in the study increased their percentage of hogs indexing 105

and over from 24 percent in 1969 to 45 percent in 1975, closely reflecting the trend for the province (Table 5); in Canada, the figures were 12.8 percent and 22.3 percent respectively.

**TABLE 5. PERCENTAGE OF HOGS INDEXING 105 AND OVER, SAMPLE FARMS, NOVA SCOTIA AND CANADA 1969-1975**

| Year | Sample Farms <sup>1</sup> | Nova Scotia | Canada |
|------|---------------------------|-------------|--------|
| 1969 | 24                        | 23.6        | 12.8   |
| 1970 | 36                        | 39.9        | 13.2   |
| 1971 | 39                        | 33.1        | 15.2   |
| 1972 | 37                        | 35.7        | 16.2   |
| 1973 | 31                        | 35.6        | 15.8   |
| 1974 | 40                        | 36.5        | 18.7   |
| 1975 | 45                        | 39.5        | 22.3   |

Source: Same as Table 3, plus the Livestock Division, Agriculture Canada.

### Feed Efficiency

Feed efficiency increased over the time period. The ratio of feed to carcass weight was 4.23:1 in 1966 compared with 3.78:1 in 1975 (Table 6). The producers in the sample increased carcass weights by about seven pounds beginning in 1969. This was the direct result of the indexed grading system initiated in that year. A heavier hog could be shipped under the index system and still obtain the highest possible grade. The increased feed

efficiency was due to a number of factors, one of which was the feeding of higher-energy feed with less importance attached to finisher rations. Pelleted feed is also given as a reason because of less waste, less dust and improved digestion.

Feed efficiency has increased in spite of a general increase in hog mortality. Some of the reasons for higher mortality are increased herd size, closer confinement, and a higher incidence of heart disease associated with leaner hogs.

### Breeding

In earlier years, hog feeder operators obtained their pigs from a large number of sow operators. In more recent years, they have narrowed their source down to one or two sow operators. This has reduced the variation in weanling quality and has improved the quality overall as these sow operators improved their breeding stock. Continued efforts will be made to improve breeding stock. More hog producers will specialize in producing F-1 gilts, most commonly from York-Landrace crosses using performance-tested stock. These will be sold to other breeders who do not wish to be concerned with the details of selecting and breeding high-quality stock. These breeders will then produce a three-way cross, most likely using a Duroc or Hampshire boar, and finish all progeny for market. These hogs have been found to be very efficient feed converters and produce a lean carcass.

**TABLE 6. EFFICIENCY FACTORS OF SEVEN NOVA SCOTIA HOG FEEDER OPERATIONS 1966-1975.**

| Item   | 1966   | 1967   | 1968   | 1969   | 1970   | 1971   | 1972   | 1973   | 1974   | 1975    |
|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
| <b>Income Factors:</b>                               |        |        |        |        |        |        |        |        |        |         |
| Labor Returns per Hog Equivalent Raised              | 9.09   | 2.05   | 4.83   | 15.82  | 3.55   | -0.99  | 14.62  | 22.05  | 8.81   | 23.31   |
| Labor Returns per Hog Marketed                       | 9.51   | 2.10   | 4.87   | 15.96  | 3.60   | -0.99  | 15.06  | 22.33  | 9.13   | 23.35   |
| Labor Returns per Hour of Labor                      | 7.50   | 1.87   | 5.06   | 15.25  | 3.27   | -1.06  | 16.92  | 25.58  | 8.47   | 21.74   |
| Farm Price Received Per Hog Marketed <sup>a</sup>    | 56.11  | 47.97  | 46.52  | 58.47  | 52.84  | 42.86  | 59.61  | 88.31  | 86.35  | 110.98  |
| <b>Cost Factors:</b>                                 |        |        |        |        |        |        |        |        |        |         |
| Feed Cost Per Hog Equivalent Raised (\$)             | 27.69  | 27.56  | 24.22  | 23.78  | 25.82  | 25.53  | 25.23  | 42.08  | 45.18  | 49.21   |
| Hours of Labor Per Hog Raised                        | 1.21   | 1.09   | 1.00   | 1.04   | 1.09   | 0.94   | 0.86   | 0.86   | 1.04   | .93     |
| Cost Per Weanling Pig Purchased (\$)                 | 15.14  | 14.21  | 14.13  | 17.34  | 15.25  | 12.79  | 17.62  | 25.86  | 25.65  | 34.02   |
| Cost of Feed (\$/cwt)                                | 4.22   | 4.36   | 4.12   | 3.93   | 4.19   | 4.26   | 4.26   | 6.96   | 8.11   | 8.19    |
| Feed Consumption Per Hog Equivalent Raised (lbs)     | 656    | 633    | 588    | 605    | 615    | 599    | 593    | 605    | 557    | 600.9   |
| Ratio of Feed to Carcass Weight                      | 4.23:1 | 4.11:1 | 3.85:1 | 3.74:1 | 3.79:1 | 3.67:1 | 3.72:1 | 3.78:1 | 3.46:1 | 3.79:1  |
| Dressed Weight Per Hog Equivalent Raised (lbs)       | 155    | 154    | 152.5  | 161.4  | 162    | 163    | 159    | 160    | 161    | 158.4   |
| Hogs Marketed (No.)                                  | 455    | 624    | 884    | 852    | 694    | 873    | 1,037  | 1,101  | 1,130  | 1,223   |
| Hog Equivalent Raised (No.)                          |        | 638    | 891    | 860    | 716    | 872    | 1,066  | 1,115  | 1,171  | 1,225.6 |
| Mortality as a Per Cent of Hog Equivalent Raised (%) | 3.4    | 2.7    | 2.2    | 2.2    | 2.1    | 3.4    | 3.7    | 5.3    | 3.8    | 4.1     |

<sup>a</sup>Includes all receipts except Inventory Change.

Source: Same as Table 3.

**TABLE 7. AVERAGE CAPITAL INVESTMENT OF SEVEN HOG FEEDER OPERATORS 1966-1975.**

| Year | Average Capital Investment |           |        |                  | Percentage of Total     |           |
|------|----------------------------|-----------|--------|------------------|-------------------------|-----------|
|      | Buildings and Equipment    | Livestock | Total  | Per Hog Marketed | Buildings and Equipment | Livestock |
|      | \$                         | \$        | \$     | \$               | %                       | %         |
| 1966 | 2,862                      | 4,881     | 7,743  | 17.02            | 36.96                   | 63.04     |
| 1967 | 5,504                      | 6,693     | 12,197 | 19.55            | 45.12                   | 54.88     |
| 1968 | 9,190                      | 8,290     | 17,479 | 19.77            | 52.57                   | 47.43     |
| 1969 | 8,643                      | 10,564    | 19,207 | 22.54            | 45.00                   | 55.00     |
| 1970 | 10,309                     | 10,513    | 20,821 | 30.00            | 49.51                   | 50.49     |
| 1971 | 11,625                     | 9,843     | 21,467 | 24.59            | 54.15                   | 45.85     |
| 1972 | 10,939                     | 12,261    | 23,200 | 22.37            | 47.15                   | 52.85     |
| 1973 | 10,547                     | 19,816    | 30,362 | 27.58            | 34.74                   | 65.26     |
| 1974 | 12,376                     | 22,358    | 34,733 | 30.74            | 35.63                   | 64.37     |
| 1975 | 19,712                     | 26,775    | 46,487 | 38.01            | 42.40                   | 57.60     |

Source: Same as Table 3.

### Weanling Pig Acquisition

In recent years the weaning age has declined. This has had a beneficial effect on feed conversion since the younger pig makes more efficient use of feed when it reaches the feeder barn. The weight of the weanling pig at time of purchase by the feeder hog operator remained unchanged over the period of the study, eliminating it as a factor in improved feed conversion. In 1975, all producers in the study purchased their pigs under a formula pricing system, with the price of market hogs and the weanling weight the main formula factors. This system was adopted to ensure a stable supply of weanling pigs but also had the advantage of sharing some of the market price instability.

One of the problems with expanding specialized feeder operations is the assured availability of a consistent supply of weanling pigs. There has been a definite trend toward farrow-to-finish operations because of the increased control over breeding programs, reduced stress on pigs and improved feed conversion. This trend is in accord with and encouraged by the Nova Scotia Department of Agriculture.

### Labor Requirements

The labor requirement for the feeder hog enterprise has varied very little during the period from one hour per hog raised (Table 6). Buildings being recommended for feeder hog production are about the same in design today as 10 years ago. Buildings with pens sloping to a central gutter is the popular design. According to a 1962 study by the Economics Branch, Agriculture Canada, Truro, securing weanling pigs required five minutes of time and a mile of driving per pig purchased. The fact that producers have been able to obtain their weanling supply from fewer sources has contributed to whatever improved efficiency that may have occurred.

### Use of Buildings and Equipment

The use of buildings and equipment and interest on investment made up 4.5 percent of production expenses in 1975. The average capital investment of farmers studied was \$46,487 in 1975 (Table 7). Capital investment per hog marketed increased from a low of \$17 in 1966 to a high of \$38.01 in 1975. Over the duration of the study, buildings and equipment accounted for 42 percent of total investment with the remaining 58 percent allocated to livestock. Land, other than the building site, was not included in the investment figures.

### SUMMARY

Over the 1966-75 period, hogs have proven to be a profitable enterprise on Nova Scotia farms. The average return to all labor during the period was \$10.49 per hog marketed, or \$10.46 per hour. This does not necessarily mean the same situation will exist in the next 10 years;

**TABLE 8. HOG PRODUCTION AND ESTIMATED CONSUMPTION, NOVA SCOTIA 1966-1975.**

| Year | Hog<br>Production | Hog<br>Consumption | Deficit<br>(lbs) | Deficit<br>(Hog Equivalents) |
|------|-------------------|--------------------|------------------|------------------------------|
|      | (000 lbs.)        | (000 lbs.)         | (000 lbs.)       | (000 hogs)                   |
| 1966 | 11,854            | 32,963             | 21,109           | 159.9                        |
| 1967 | 13,863            | 37,699             | 23,836           | 180.6                        |
| 1968 | 15,381            | 37,772             | 22,391           | 169.6                        |
| 1969 | 15,668            | 36,319             | 20,651           | 156.4                        |
| 1970 | 15,906            | 38,760             | 22,299           | 168.9                        |
| 1971 | 17,318            | 48,284             | 30,966           | 234.6                        |
| 1972 | 16,249            | 45,496             | 29,247           | 221.6                        |
| 1973 | 16,183            | 43,470             | 27,287           | 206.7                        |
| 1974 | 16,351            | 45,040             | 28,689           | 217.3                        |
| 1975 | 15,772            | 37,976             | 22,204           | 168.2                        |

Source: Statistics Canada, Maritime Office, Truro, Nova Scotia

however, there appears to be a good income opportunity for Nova Scotia farmers in hog production. The deficit position of Nova Scotia in pork and the fact that there are no quota restrictions favor some expansion of hog production (Table 8). Restricting factors in recent years have been variability of price,

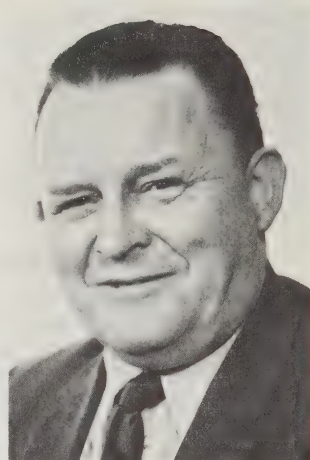
the uncertainty of cost and environmental regulations, and the difficulties these create in obtaining financing. The recent hog stabilization plan should eliminate some of the uncertainties and the federal-provincial capital grants program should provide adequate incentive for expanded production.

# FERTILIZATION DECISIONS AND SOIL MOISTURE IN THE BROWN SOIL ZONE



*This article examines the value of taking into account soil moisture levels in fertilizer decisions in the Brown Soil Zone in southern Saskatchewan. Expected optimal nitrogen and phosphorus levels for wheat were calculated under a range of nutrient prices, product prices and soil moisture situations.<sup>1</sup> The results showed that under most situations studied adjustments in the nutrient levels according to the available soil moisture were advantageous, especially under conditions of high soil moisture.*

*R.P. Zentner and D.W.L. Read\**



## INTRODUCTION

The use of commercial fertilizer is a proven and expanding practice in Saskatchewan agriculture. For farmers, decisions regarding fertilizer use depend on physical factors such as the crop grown, soil texture and soil nutrient status, and economic considerations such as fertilizer prices, product prices, market opportunities and resource limitations. While the physical factors determine crop yields, the economic considerations determine the levels of fertilization that will maximize profit.

From time to time research uncovers considerations that farmers should evaluate. One concerns adjusting fertilization rates for different levels of soil moisture.<sup>2</sup>

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<sup>1</sup> Optimal as used here refers to the highest expected value.

<sup>2</sup> Adjusting fertilizer rates for soil moisture levels at planting time is not a new discovery. It is, however, a practice not widely adopted by farmers (except possibly on an intuitive basis) or agencies responsible for making fertilizer recommendations. Consequently, it is important to assess whether this practice has value in terms of increasing net returns.

Experiments conducted in Western Canada by Agriculture Canada have shown that the response of cereals on stubble to fertilizer is directly related to the level of soil moisture at planting time. This relationship may provide valuable information for farmers, enabling them to improve the accuracy of their yield forecasts and thereby use fertilizers more efficiently.<sup>3</sup>

The purpose of this study is to assess the value of considering soil moisture at planting time in fertilizer decisions. Specifically the study will:

- use experimental data collected by Agriculture Canada to develop two yield-forecasting equations – one that explicitly considers soil moisture at planting time and one that does not;
- use the equations to calculate expected optimal nutrient levels for various price levels of fertilizer and product; and
- superimpose the expected optimal nutrient levels on actual weather data to assess the net benefits (difference in net returns) from using the two estimates.

<sup>3</sup> The value of a "bit" of information refers to the change in the farmer's net position (e.g., net returns) with the information relative to his net position without the information.

**TABLE 1. SUMMARY OF DATA RECORDED ON STUBBLE PLOTS FOR SELECTED FERTILIZER COMBINATIONS<sup>a</sup>**

| Year | Number of tests | Growing season rainfall (inches) | Available soil moisture (inches) | Soil nitrogen (lbs. per acre) | Soil phosphate (lbs. per acre) | Check yield (zero fert.) (bu. per acre) | Yield increase over check due to fertilizer |  |  |  |  |
|------|-----------------|----------------------------------|----------------------------------|-------------------------------|--------------------------------|---|---|--|--|--|--|
|      |                 |                                  |                                  |                               |                                |   | N =30<br>P <sub>2</sub> O <sub>5</sub> = 0  | N =15<br>P <sub>2</sub> O <sub>5</sub> =20 | N =30<br>P <sub>2</sub> O <sub>5</sub> =20 | N =60<br>P <sub>2</sub> O <sub>5</sub> =20 | N =30<br>P <sub>2</sub> O <sub>5</sub> =30 |
|      |                 |                                  |                                  |                               |                                |   | — bu. per acre —                            |  |  |  |  |
| 1971 | 5               | 4.65                             | 3.82                             | 20.3                          | 8.8                            | 8.2                                     | 5.2   | 3.8  | 6.0  | 8.2  | *  |
| 1970 | 13              | 7.99                             | 5.00                             | 22.0                          | 12.3                           | 12.5                                    | 8.5   | 5.1  | 8.9  | 13.8                                       | 9.2  |
| 1969 | 14              | 6.10                             | 4.06                             | 35.2                          | 13.2                           | 12.9                                    | 5.7   | 4.3  | 6.2  | 7.0  | 6.3  |
| 1968 | 13              | 2.80                             | 2.32                             | 37.9                          | 16.7                           | 6.4                                     | 1.5   | 1.1  | 1.5  | 2.0  | 3.1  |
| 1967 | 14              | 1.93                             | 6.42                             | 37.0                          | 15.9                           | 10.5                                    | 2.1   | 1.6  | 2.2  | 2.6  | 3.1  |
| 1966 | 8               | 7.17                             | 5.87                             | 39.6                          | 15.9                           | 16.4                                    | 12.6  | *  | 10.8                                       | 15.3                                       | *  |

<sup>a</sup>The values in the table represent averages for the number of tests.

\*No fertilizer treatments of that type were performed in that year.

## THE EXPERIMENTAL DATA

Results from 67 individual fertilization experiments conducted by the Agriculture Canada Research Station at Swift Current, Saskatchewan, during the period from 1966 to 1971 serve as the data base for this study. The tests were performed on clay-loam soils in the Brown Soil Zone of southern Saskatchewan. Chinook hard red spring wheat was sown at a rate of 65 pounds per acre on wheat stubble (wheat-wheat-fallow rotation). As many as 12 fertilizer combinations were tested on each plot. Application rates of actual nitrogen (N) and phosphorus (P<sub>2</sub>O<sub>5</sub>) ranged from 0 to 60 and 0 to 40 pounds per acre respectively. All P<sub>2</sub>O<sub>5</sub> and up to 20 pounds of N per acre were applied with the seed. For rates of more than 20 pounds per acre the N was broadcast before seeding. At planting time, each site was tested for soil nitrogen in the top 24 inches of soil, soil phosphorus (P) (NaHCO<sub>3</sub>-soluble phosphorus) in the top six inches, and available soil moisture<sup>4</sup> (SM) in the top 48 inches. Rainfall was recorded daily at each site during the growing season. At maturity the test plots were harvested and grain yields were calculated.

Table 1 summarizes data from the test plots. Growing-season rainfall (May-July) was highly variable among experimental sites and years, ranging from an average of 7.99 inches in 1970 to 1.93 inches in 1967. Available soil moisture was also highly variable among sites and years, ranging from an average of 6.42 inches in 1967 to 2.32 inches in 1968. Soil N and P exhibited similar patterns. The average level of soil N ranged from 39.6 pounds per acre in 1966 to 20.3 pounds per acre in

1971. Soil P was highest in 1968, averaging 16.7 pounds per acre, and lowest in 1971, averaging 8.8 pounds per acre. Wheat yields varied considerably among sites and years, presumably because of the differences in moisture and nutrient levels. Check yields were highest in 1966, averaging 16.4 bushels per acre, and lowest in 1968, averaging 6.4 bushels per acre. Yield increases due to fertilizer were greatest in years of high soil moisture and low soil nutrient levels.

## METHOD OF ANALYSIS

Multiple-regression analysis was used to develop two second-order polynomial yield-forecasting equations<sup>5</sup>. The equations contain relationships of factors that are known or measurable when fertilizer decisions are made. The first equation uses total available nitrogen (TN) and phosphorus (TP) at planting time as independent variables<sup>6</sup>. In addition to these variables, the second equation takes into account the level of available soil moisture at planting time.

To develop the equations, soil-test nitrogen and nitrogen fertilizer were assumed to be equally available to the plants and thus additive (TN = soil test N + fertilizer N). Soil test phosphorus and P<sub>2</sub>O<sub>5</sub> fertilizer were also assumed to be additive with an appropriate transformation: TP = soil test P + .43662 x rate of P<sub>2</sub>O<sub>5</sub> fertilizer<sup>7</sup>.

<sup>5</sup>Other functional forms of equations were examined, but only the results for the second-order polynomial are presented.

<sup>6</sup>Most fertilizer recommendations are based on this method, but this should not be the case if other factors, especially those that can be measured before the actual decision, are shown to be important.

<sup>7</sup>This transformation is required to adjust P<sub>2</sub>O<sub>5</sub> to P<sub>2</sub> by the ratio of the respective atomic weights.

<sup>4</sup>Available soil moisture is the amount a plant can use from all depths within its root zone. It is the amount of moisture in excess of the plant's permanent wilting point.

Both equations were used to calculate optimal nutrient levels *ex ante* (before the effects of growing season rainfall were observed) for a range of prices for wheat and nutrients. The first equation gives no consideration to available soil moisture while the second equation takes into account three levels of available soil moisture. Soil test nitrogen and phosphorus were valued according to prevailing fertilizer prices.

The net benefit from using the two forecasting equations for calculating expected optimal nutrient levels was assessed over the 35-year period 1941 to 1975 at Swift Current. The net benefit is defined as the difference in net returns (dollar value of the actual yield for the given set of conditions less the cost of the calculated nutrient levels) that result when consideration is given to the level of available soil moisture. No cost was associated with measuring the level of available soil moisture and thus the net benefit can be regarded as the maximum price a farmer should be willing to pay for this "bit" of information.

The actual yields that result under the various nutrient, available soil moisture and historical growing-season rainfall levels were calculated from a third yield equation<sup>8</sup>. This equation contains relationships of the amount and distribution of growing season rainfall as well as nutrient availability and available soil moisture at planting time<sup>9</sup>. The yield estimates from this equation formed the standard with which each of the previous yield-forecasting equations was compared.

## THE EMPIRICAL RESULTS

The relationship of wheat yield to levels of total nitrogen and phosphorus at planting time is given by equation 1 (see footnote). The relationship explains 42 percent of the variation in the yield data and is statistically significant (probability of less than 1 percent that none of the variables are significant). Both factor

inputs exhibit diminishing marginal physical products (MPP)<sup>10</sup>, as expected.

Equation 2 presents the relationship of wheat yield to levels of total nitrogen, phosphorus, and available soil moisture (SM) at planting time (see footnote). The relationship accounts for 61 percent of the variation in the yield data and is statistically significant at the same level as equation 1. Declining marginal physical products of the factor inputs are again evident.

Intuitively, one might expect that fertilizer decisions developed from equation 2 would give higher net returns than those from equation 1, since equation 2 accounts for a higher percentage of the variation in the yield data. This may not be the case, however, as yields also depend on the amount and distribution of growing-season rainfall. Because the level of fertilizer must be decided without knowing how much rain will fall, it is possible that the differential effects of growing-season rainfall will counteract the best estimate of yield made in the spring.

## Optimal Nutrient Levels

The expected optimal levels of nutrients for each yield-forecasting equation were calculated<sup>11</sup>. Table 2 contains the optimal levels of nitrogen and phosphorus from equation 1 for four wheat and five nutrient price levels. Wheat prices range from \$3.00 to \$4.50 per bushel while, prices for N and P range from \$0.12 to \$0.20 and \$0.22 to \$0.42 per pound, respectively<sup>12</sup>. As one might expect, the optimal nutrient levels are quite sensitive to the price relationships. Decreasing prices for nutrients and increasing prices for wheat favor higher nutrient levels. The optimal nutrient levels, for any nutrient price, rise with the price for wheat, but at a decreasing rate. This occurs because of the diminishing marginal physical products of the nutrients.

<sup>8</sup>The derivation and complete description of this equation is contained in Read, D.W.L. and R.P. Zentner, "The Relationships of Factors Affecting Wheat Production in the Brown Soil Zone", currently under review. Interested readers may obtain a working copy of this paper by contacting the authors directly.

<sup>9</sup>This equation was used to estimate the actual yields that would result under the various nutrient combinations since the calculated nutrient levels did not necessarily correspond to any experimental treatments.

### Equation 1

$$\text{Yield (bu. per acre)} = 6.374 + 0.14830 \text{ TN} + 0.38243 \text{ TP} \\ - 0.00142 \text{ TN}^2 - 0.01163 \text{ TP}^2 + 0.00312 \text{ TN TP}$$

<sup>10</sup>The marginal physical product of any factor refers to the extra output obtained from each additional increment in the level of that factor, holding all other factors constant. It is generally true that successive increments in a variable factor, with all other factors fixed, will increase output at a decreasing rate.

### Equation 2

Yield (bu. per acre)

$$= -4.699 + 0.12218 \text{ TN} + 0.02060 \text{ TP} + 5.57078 \text{ SM} \\ - 0.00214 \text{ TN}^2 - 0.00529 \text{ TP}^2 - 0.60168 \text{ SM}^2 \\ + 0.02898 \text{ TN SM} - 0.01581 \text{ TP SM} + 0.00279 \text{ TN TP}$$

<sup>11</sup>See appendix for explanation and calculation.

<sup>12</sup>See appendix for description of nutrient prices in terms of costs per ton for four common fertilizer types.

**TABLE 2. OPTIMAL LEVELS OF NITROGEN AND PHOSPHORUS UNDER VARIOUS NUTRIENT AND WHEAT PRICES, CALCULATED FROM EQUATION 1<sup>a</sup>**

| Price of Nutrient (\$ per lb.) |      | Price of Wheat (\$ per bushel) |        |        |        |        |        |        |        |
|--------------------------------|------|--------------------------------|--------|--------|--------|--------|--------|--------|--------|
| N                              | P    | 3.00                           | 3.50   | 4.00   | 4.50   |        |        |        |        |
|                                |      | lbs. N                         | lbs. P | lbs. N | lbs. P | lbs. N | lbs. P | lbs. N | lbs. P |
| 0.12                           | 0.22 | 61                             | 21     | 64     | 22     | 66     | 23     | 68     | 23     |
| 0.14                           | 0.27 | 58                             | 20     | 61     | 21     | 64     | 22     | 66     | 23     |
| 0.16                           | 0.32 | 54                             | 19     | 58     | 20     | 61     | 21     | 63     | 22     |
| 0.18                           | 0.37 | 50                             | 18     | 55     | 19     | 58     | 20     | 61     | 21     |
| 0.20                           | 0.42 | 47                             | 17     | 52     | 18     | 56     | 19     | 59     | 20     |

<sup>a</sup>The values in the table have been rounded to the nearest pound.

Table 3 shows the optimal levels of nitrogen and phosphorus calculated from equation 2 for three levels of available soil moisture. The optimal levels of N are very dependent on the level of available soil moisture. High levels of available soil moisture favor high levels of

**TABLE 3. OPTIMAL LEVELS OF NITROGEN AND PHOSPHORUS UNDER VARIOUS NUTRIENT AND WHEAT PRICES, CALCULATED FROM EQUATION 2 FOR THREE LEVELS OF SOIL MOISTURE (SM)<sup>a</sup>**

| Price of Nutrient (\$ per lb.) |      | Price of Wheat (\$ per bushel) |        |        |        |        |        |        |        |
|--------------------------------|------|--------------------------------|--------|--------|--------|--------|--------|--------|--------|
| N                              | P    | 3.00                           | 3.50   | 4.00   | 4.50   |        |        |        |        |
|                                |      | lbs. N                         | lbs. P | lbs. N | lbs. P | lbs. N | lbs. P | lbs. N | lbs. P |
| SM = 3.0 inches                |      |                                |        |        |        |        |        |        |        |
| 0.12                           | 0.22 | 53                             | 22     | 56     | 23     | 58     | 24     | 59     | 25     |
| 0.14                           | 0.27 | 50                             | 19     | 53     | 21     | 55     | 23     | 57     | 24     |
| 0.16                           | 0.32 | 47                             | 17     | 51     | 19     | 53     | 21     | 55     | 22     |
| 0.18                           | 0.37 | 44                             | 15     | 48     | 17     | 51     | 19     | 53     | 21     |
| 0.20                           | 0.42 | 41                             | 13     | 46     | 16     | 49     | 18     | 51     | 19     |
| SM = 4.5 inches                |      |                                |        |        |        |        |        |        |        |
| 0.12                           | 0.22 | 64                             | 22     | 66     | 24     | 68     | 25     | 70     | 26     |
| 0.14                           | 0.27 | 61                             | 20     | 64     | 22     | 66     | 23     | 68     | 24     |
| 0.16                           | 0.32 | 58                             | 18     | 61     | 20     | 64     | 22     | 66     | 23     |
| 0.18                           | 0.37 | 55                             | 15     | 59     | 18     | 61     | 20     | 64     | 22     |
| 0.20                           | 0.42 | 52                             | 13     | 56     | 16     | 59     | 18     | 62     | 20     |
| SM = 6.0 inches                |      |                                |        |        |        |        |        |        |        |
| 0.12                           | 0.22 | 74                             | 22     | 77     | 24     | 79     | 26     | 80     | 26     |
| 0.14                           | 0.27 | 71                             | 20     | 74     | 22     | 76     | 24     | 78     | 25     |
| 0.16                           | 0.32 | 68                             | 18     | 72     | 20     | 74     | 22     | 76     | 24     |
| 0.18                           | 0.37 | 65                             | 16     | 69     | 19     | 72     | 20     | 74     | 22     |
| 0.20                           | 0.42 | 62                             | 14     | 67     | 17     | 70     | 18     | 72     | 21     |

<sup>a</sup>The values in the table have been rounded to the nearest pound.

N and vice versa. The optimal levels of P are, however, quite independent of the level of available soil moisture. The optimal levels for both nutrients are also very dependent on the price relationships. Low nutrient prices and high wheat prices favor high nutrient levels. The optimal nutrient levels also exhibit diminishing marginal physical products with respect to increasing prices for wheat.

## Net Benefits

The net benefits from considering available soil moisture levels in the fertilization decisions were calculated for each of 35 years by superimposing the nutrient, soil moisture and historical growing-season rainfall levels onto the third yield equation. Table 4 shows a sample calculation of the net benefits when available soil moisture is 4.5 inches, the price of wheat is \$3.00 per bushel, and prices for N and P are \$0.12 and \$0.22 per pound, respectively. The net benefit in any year may be positive or negative, depending on the differential effects of the growing-season rainfall. As a result, a high degree of variation in the net benefits develops over time.

Table 5 shows the mean and standard deviation of the net benefits for all price situations and three levels of available soil moisture. The average benefits are positive under most price and soil moisture situations. The benefit from adjusting nutrient levels for levels of available soil moisture increases with the level of soil moisture. The average benefit is negative when soil moisture and nutrient prices are low and wheat prices are high. However, the combinations of high wheat prices and low nutrient prices represent highly unlikely price situations.

The standard deviations of the net benefits are large under most price and moisture situations. The high variability is caused by the effects of the highly variable growing-season rainfall levels that occurred over the 35-year period at Swift Current.

The standard deviations can be used for calculating probabilities of receiving positive benefits from considering the level of available soil moisture, for any price and soil moisture situation. For example, when available soil moisture is 4.5 inches and prices for wheat, N and P are \$3.00 per bushel, \$0.12 per pound and \$0.22 per pound, respectively, one would expect positive benefits 62 percent of the time. If the available soil moisture is 3.0 inches, at these prices one would expect positive benefits to accrue 43 percent of the time. Similarly, if available soil moisture is 6.0 inches, there is a 93-percent probability of receiving positive

**TABLE 4. SAMPLE CALCULATION OF NET BENEFITS FROM CONSIDERATION OF AVAILABLE SOIL MOISTURE (SM)<sup>a</sup>**

| Year                  | Equation 1         |               | Equation 2         |               | Net benefit <sup>c</sup><br>Equation 2<br>less equation 1 |
|-----------------------|--------------------|---------------|--------------------|---------------|---|
|                       | Yield <sup>b</sup> | Net<br>return | Yield <sup>b</sup> | Net<br>return |   |
|                       | bu./acre           | \$/acre       | bu./acre           | \$/acre       | \$/acre   |
| 1941                  | 22.4               | 54.90         | 22.7               | 55.30         | 0.30  |
| 1942                  | 24.1               | 59.90         | 24.5               | 60.80         | 0.90  |
| 1943                  | 14.0               | 29.80         | 13.9               | 29.10         | -0.70   |
| 1944                  | 30.5               | 79.20         | 30.5               | 78.90         | -0.30   |
| 1945                  | 12.0               | 23.90         | 12.2               | 23.90         | 0.00  |
| 1946                  | 21.2               | 51.50         | 21.6               | 52.20         | 0.70  |
| 1947                  | 19.7               | 47.00         | 20.0               | 47.30         | 0.30  |
| 1948                  | 17.4               | 39.90         | 17.8               | 40.60         | 0.70  |
| 1949                  | 23.8               | 59.10         | 24.0               | 59.20         | 0.10  |
| 1950                  | 24.0               | 59.90         | 24.5               | 60.80         | 0.90  |
| 1951                  | 20.0               | 47.80         | 20.2               | 47.90         | 0.10  |
| 1952                  | 18.6               | 43.50         | 18.8               | 43.60         | 0.10  |
| 1953                  | 9.2                | 15.50         | 9.3                | 15.10         | -0.40   |
| 1954                  | 21.2               | 51.50         | 21.5               | 51.80         | 0.30  |
| 1955                  | 33.7               | 89.00         | 33.9               | 88.90         | -0.10   |
| 1956                  | 24.1               | 60.00         | 24.4               | 60.50         | 0.50  |
| 1957                  | 25.2               | 63.40         | 25.5               | 63.80         | 0.40  |
| 1958                  | 15.8               | 35.30         | 16.1               | 35.60         | 0.30  |
| 1959                  | 15.4               | 34.10         | 15.7               | 34.50         | 0.40  |
| 1960                  | 23.8               | 59.20         | 24.1               | 59.70         | 0.50  |
| 1961                  | 20.4               | 48.80         | 20.5               | 48.70         | -0.10   |
| 1962                  | 25.7               | 64.90         | 26.1               | 65.60         | 0.70  |
| 1963                  | 15.7               | 35.00         | 16.1               | 35.50         | 0.50  |
| 1964                  | 13.0               | 26.70         | 13.2               | 26.70         | 0.10  |
| 1965                  | 15.1               | 33.00         | 15.2               | 32.70         | -0.30   |
| 1966                  | 16.1               | 36.00         | 16.4               | 36.50         | 0.40  |
| 1967                  | 11.7               | 23.00         | 11.7               | 22.40         | -0.50   |
| 1968                  | 17.6               | 40.50         | 17.7               | 40.20         | -0.30   |
| 1969                  | 21.4               | 52.00         | 21.7               | 52.30         | 0.30  |
| 1970                  | 16.6               | 37.50         | 16.9               | 37.90         | 0.30  |
| 1971                  | 20.0               | 47.80         | 20.4               | 48.60         | 0.70  |
| 1972                  | 12.0               | 23.90         | 12.0               | 23.30         | -0.60   |
| 1973                  | 10.9               | 20.60         | 11.1               | 20.50         | -0.10   |
| 1974                  | 17.4               | 39.90         | 17.2               | 38.80         | -1.10   |
| 1975                  | 21.7               | 52.90         | 21.9               | 52.90         | 0.00  |
| Mean                  | 19.2               | 45.34         | 19.4               | 45.48         | 0.14  |
| Standard<br>Deviation | 5.5                | 16.55         | 5.6                | 16.72         | 0.47  |

<sup>a</sup>SM = 4.5 inches, wheat price = \$3.00 per bushel, and prices for N and P are \$0.12 and \$0.22 per pound, respectively.

<sup>b</sup>Yield calculated by superimposing the optimal nutrient levels, available soil moisture and historical growing-season rainfall onto the third yield relationship.

<sup>c</sup>Any discrepancies are due to rounding of figures.

benefits from adjusting the fertilization levels according to the level of available soil moisture<sup>1,3</sup>.

Although variability exists, mainly because of the effects of the unknown growing-season rainfall, the results of this analysis support adjustment of fertilization for levels of available soil moisture. Consequently, it is recommended that farmers, extension personnel and soil-test laboratories consider levels of available soil moisture at planting time when making fertilizer recommendations and plans.

## SUMMARY AND CONCLUSION

This study was undertaken to examine the value (net returns) of considering available soil moisture in fertilizer decisions. The analysis was based on research data collected by the Agriculture Canada Research Station, Swift Current, Saskatchewan between 1966 and 1971. These data were used to develop two yield forecasting equations, one that considers the level of soil moisture at planting time and one that does not. The yield relationships were used to calculate expected optimal nitrogen and phosphorus levels under a range of nutrient prices, product prices, and soil moisture situations. The net benefits (net returns) from using both estimates were evaluated over 35 years of actual weather data. The results showed that under most situations studied adjustments in the nutrient levels for available soil moisture were advantageous, especially under conditions of high soil moisture.

Although the data are from one experiment, the results are much more generally applicable. Consideration of levels of available soil moisture at planting time provides additional information that enables more accurate estimates of final yields. The result will be fertilization strategies that make more efficient use of fertilizer inputs and that, at the same time, have higher chances of economic success.

<sup>1,3</sup>The area under a normal distribution of one standard deviation to the left of the mean represents a probability level of about 84 percent. Two standard deviations to the left of the mean represent a probability of about 97 percent.

**TABLE 5. NET BENEFIT FROM ADJUSTING FERTILIZATION DECISIONS FOR LEVELS OF AVAILABLE SOIL MOISTURE (\$M)**

| Price of Nutrient (\$ per lb.) |      | Price of Wheat (\$ per bushel)         |              |              |              |
|--------------------------------|------|--|--------------|--------------|--------------|
| N                              | P    | 3.00                                   | 3.50         | 4.00         | 4.50         |
| — \$ per acre —                |      |  |              |              |              |
| SM = 3.0 inches                |      |  |              |              |              |
| 0.12                           | 0.22 | -0.18 <sup>a</sup> (0.98) <sup>b</sup> | -0.36 (1.40) | -0.52 (1.87) | -0.66 (2.37) |
| 0.14                           | 0.27 | 0.04 (0.93)                            | -0.18 (1.14) | -0.37 (1.52) | -0.53 (1.98) |
| 0.16                           | 0.32 | 0.31 (1.15)                            | 0.04 (1.10)  | -0.18 (1.29) | -0.37 (1.65) |
| 0.18                           | 0.37 | 0.63 (1.53)                            | 0.31 (1.30)  | 0.04 (1.27)  | -0.18 (1.46) |
| 0.20                           | 0.42 | 1.00 (1.98)                            | 0.62 (1.65)  | 0.31 (1.45)  | 0.05 (1.44)  |
| SM = 4.5 inches                |      |  |              |              |              |
| 0.12                           | 0.22 | 0.14 (0.47)                            | -0.07 (0.90) | -0.26 (1.37) | -0.44 (1.86) |
| 0.14                           | 0.27 | 0.45 (0.45)                            | 0.19 (0.50)  | -0.03 (0.90) | -0.23 (1.37) |
| 0.16                           | 0.32 | 0.81 (0.86)                            | 0.50 (0.51)  | 0.24 (0.53)  | 0.02 (0.90)  |
| 0.18                           | 0.37 | 1.21 (1.35)                            | 0.85 (0.90)  | 0.58 (0.59)  | 0.29 (0.56)  |
| 0.20                           | 0.42 | 1.66 (1.87)                            | 1.24 (1.39)  | 0.90 (0.95)  | 0.60 (0.61)  |
| SM = 6.0 inches                |      |  |              |              |              |
| 0.12                           | 0.22 | 2.43 (1.69)                            | 2.51 (2.06)  | 2.62 (2.50)  | 2.73 (2.98)  |
| 0.14                           | 0.27 | 2.83 (1.70)                            | 2.86 (1.94)  | 2.93 (2.30)  | 3.03 (2.72)  |
| 0.16                           | 0.32 | 3.27 (1.88)                            | 3.25 (1.97)  | 3.29 (2.20)  | 3.36 (2.54)  |
| 0.18                           | 0.37 | 3.76 (2.17)                            | 3.74 (2.17)  | 3.69 (2.23)  | 3.72 (2.47)  |
| 0.20                           | 0.42 | 4.30 (2.53)                            | 4.17 (2.40)  | 4.12 (2.38)  | 4.12 (2.50)  |

<sup>a</sup>The values in the table represent the average increase in net returns (\$ per acre) that result from adjusting nutrient levels for the effects of available soil moisture.

<sup>b</sup>Standard deviation of the net benefits over 35 years.

## APPENDIX

### Optimal Nutrient Levels

The optimal levels of nutrient application can be determined by equating the nutrient-product price ratios with the extra yield associated with unit increases in nutrient applications (MPP). Since the marginal physical products of the nutrients are declining, a point will be reached where no additional benefits (net returns) will result from further increases in the nutrient levels. Equations a and b represent the MPP equations for TN and TP, respectively, as derived from equation 1.

$$\frac{\partial \text{Yield}_1}{\partial \text{TN}} = 0.14730 - 0.00284 \text{ TN} + 0.00312 \text{ TP} \quad \text{a}$$

$$\frac{\partial \text{Yield}_1}{\partial \text{TP}} = 0.38243 - 0.02326 \text{ TP} + 0.00312 \text{ TN} \quad \text{b}$$

The MPP curves for TN and TP as derived from equation 2 are represented in equations c and d, respectively.

$$\frac{\partial \text{Yield}_2}{\partial \text{TN}} = 0.12218 - 0.00428 \text{ TN} + 0.02898 \text{ SM} + 0.00279 \text{ TP} \quad \text{c}$$

$$\frac{\partial \text{Yield}_2}{\partial \text{TP}} = 0.20260 - 0.01058 \text{ TP} - 0.01581 \text{ SM} + 0.00279 \text{ TN} \quad \text{d}$$

### Nutrient Prices

The following table was developed to provide the reader with a better appreciation of nutrient prices. The table describes the nutrient prices in terms of costs per ton for several common fertilizer types. The price of P in terms of P<sub>2</sub>O<sub>5</sub> fertilizer was assumed to follow the price of N but at a \$.02 per-pound lower price.

| Type of Fertilizer  | Price of Nutrient (\$ per pound) |     |        |     |        |     |        |     |        |     |
|---------------------|----------------------------------|-----|--------|-----|--------|-----|--------|-----|--------|-----|
|                     | N                                |     | P      |     | N      |     | P      |     | N      |     |
|                     | .12                              | .22 | .14    | .27 | .16    | .32 | .18    | .37 | .20    | .42 |
| — dollars per ton — |                                  |     |        |     |        |     |        |     |        |     |
| 34-00-0             | 81.60                            |     | 95.20  |     | 108.80 |     | 122.40 |     | 136.00 |     |
| 23-23-0             | 101.20                           |     | 119.60 |     | 138.00 |     | 156.40 |     | 174.80 |     |
| 16-20-0             | 78.40                            |     | 92.80  |     | 107.20 |     | 121.60 |     | 136.00 |     |
| 11-48-0             | 122.39                           |     | 145.98 |     | 169.58 |     | 193.22 |     | 216.82 |     |

# CANADIAN WHEAT FLOUR SITUATION



J.S. Carmichael\*

*Canadian flour production has been relatively stable since the mid-fifties after declining from its peak in the 1946-47 crop year when 3.2 million tonnes of wheat were milled. Flour exports, which also peaked in 1946-47, at an equivalent of 2.07 million tonnes of wheat, dropped substantially, to only .5 million tonnes of wheat equivalent in 1974-75. The outlook for expansion in exports is not optimistic.*

## INTRODUCTION

Flour milling in Canada reached a peak in the 1946-47 crop year when about 3.2 million tonnes of wheat were milled. From the end of World War II until the early fifties, more than 2.7 million tonnes were milled each year. Milling then declined until the mid-fifties and since then it has been relatively stable, except for 1963-64 when just over 3 million tonnes were milled. This was the first year of several years of large imports of flour by the U.S.S.R. Data for the early months of 1975-76 indicate the probability of a slight increase in millings over the 2.42 million tonnes of wheat ground in 1974-75.

There has also been a gradual decline in exports, a decline that has not been fully offset by a gradual increase in domestic use. A major factor affecting the Canadian milling industry has been the growth of flour milling in many former importing countries, particularly the less developed countries. For example, some Arab countries are either refurbishing old mills or building new ones. Saudi Arabia is about to set up a new milling industry with three plants, one with a capacity of 810 tonnes of wheat per day and two with capacities of

270 tonnes per day. Another factor influencing the level of Canadian flour exports has been the market-disrupting export subsidies of some flour-exporting countries.

## MILLING INDUSTRY

Until the 1960s, more than half of the wheat milling in Canada was done in the West where the industry was geared to the export market. Now, however, about 70 percent of the industry is located in eastern Canada as a result of increasing population there and the fact that declining exports have reduced the importance of milling in the West.

As milling technology advanced, the small mills of the pre-war period gave way to larger mills with capacities generally ranging between 90 and 900 tonnes per day. In 1922, there were 801 flour mills reported (Table 4). The number declined very rapidly between 1922 and 1930 and between 1948 and 1959<sup>1</sup>. By 1976, there were only 41 active mills - 20 in Ontario, four in Quebec, one in Nova Scotia, five in each of Saskatchewan and Manitoba and six in Alberta.

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<sup>1</sup>Partly because of changes in enumeration method by Statistics Canada.

**TABLE 1. WHEAT MILLED FOR FLOUR, FLOUR PRODUCED AND EXPORTED, SELECTED CROP YEARS, 1945-46 TO 1974-75**

| August 1—<br>July 31 | Wheat milled<br>for flour | Wheat flour<br>produced<br>including low<br>grade | Wheat flour<br>exported <sup>a</sup> | Flour<br>available for<br>domestic<br>use | Wheat flour<br>exports<br>in wheat<br>equivalent |
|----------------------|---------------------------|---|--------------------------------------|---|--|
| — million tonnes —   |                           |   |                                      |   |  |
| 1945-46              | 3,214                     | 2,359   | 1,288                                | 1,070                                     | 1,788  |
| 1950-51              | 2,904                     | 2,100   | 1,107                                | 0,998                                     | 1,521  |
| 1955-56              | 2,498                     | 1,819   | 0,789                                | 1,034                                     | 1,089  |
| 1960-61              | 2,441                     | 1,810   | 0,703                                | 1,107                                     | 0,972  |
| 1961-62              | 2,400                     | 1,792   | 0,630                                | 1,161                                     | 0,871  |
| 1962-63              | 2,145                     | 1,610   | 0,540                                | 1,075                                     | 0,743  |
| 1963-64              | 3,040                     | 2,273   | 1,084                                | 1,188                                     | 1,494  |
| 1964-65              | 2,373                     | 1,774   | 0,621                                | 1,152                                     | 0,857  |
| 1965-66              | 2,643                     | 2,064   | 0,753                                | 1,225                                     | 1,037  |
| 1966-67              | 2,452                     | 1,814   | 0,626                                | 1,184                                     | 0,868  |
| 1967-68              | 2,308                     | 1,715   | 0,485                                | 1,225                                     | 0,672  |
| 1968-69              | 2,313                     | 1,706   | 0,485                                | 1,220                                     | 0,670  |
| 1969-70              | 2,466                     | 1,796   | 0,531                                | 1,266                                     | 0,735  |
| 1970-71              | 2,381                     | 1,746   | 0,490                                | 1,256                                     | 0,675  |
| 1971-72              | 2,397                     | 1,774   | 0,485                                | 1,284                                     | 0,672  |
| 1972-73              | 2,351                     | 1,724   | 0,463                                | 1,266                                     | 0,637  |
| 1973-74              | 2,305                     | 1,696   | 0,372                                | 1,325                                     | 0,501  |
| 1974-75              | 2,420                     | 1,769   | 0,367                                | 1,402                                     | 0,509  |

<sup>a</sup>Based on Customs returns, exports adjusted to remove effect of time lag in reporting.

Source: Statistics Canada, Grain Trade of Canada, numerous issues.

Employment in flour milling appears to have reached a peak in 1947, then declined about 30 percent during the next 10 to 12 years. Between 1961 and 1970, the number of employees decreased from 2,665 to 2,203. Since that time, the increasing activities of flour mills in

the feed-milling industry have made it difficult to estimate employment in flour milling alone and reports are not available. Some flour-milling companies have broadened their activities to include animal-feed mills, which use the by-products from flour milling.

**TABLE 2. PRINCIPAL TYPES OF WHEAT MILLED FOR FLOUR IN CANADA, CROP YEARS 1964-65, 1969-70 AND 1974-75**

| Type of Wheat             | Grindings (million tonnes) |         |         | Percentage of<br>total grind |
|---------------------------|----------------------------|---------|---------|------------------------------|
|                           | 1964-65                    | 1969-70 | 1974-75 | 1974-75                      |
| Canada Western Red Spring | 2,076                      | 2,078   | 1,971   | 81.5                         |
| Alberta Red Winter        | —                          | —       | 0,048   | 2.0                          |
| Alberta Soft White Spring | —                          | —       | 0,070   | 2.9                          |
| Durum                     | 0,084                      | 0,121   | 0,148   | 6.1                          |
| Ontario Winter            | 0,187                      | 0,226   | 0,175   | 7.2                          |
| Other <sup>a</sup>        | 0,026                      | 0,040   | 0,007   | —                            |
| Total <sup>b</sup>        | 2,373                      | 2,465   | 2,419   | 100.0                        |

<sup>a</sup>Source does not indicate breakdown, presumed to be largely Alberta wheats plus small quantities of Ontario and Quebec spring wheat.

<sup>b</sup>Includes Ontario and Quebec spring wheat in 1974-75.

Source: Statistics Canada, Grain Trade of Canada.

**TABLE 3 — WHEAT MILLINGS IN CANADA BY REGION**

| Year    | Western            | % of total | Eastern            | % of total |
|---------|--------------------|------------|--------------------|------------|
|         | — million tonnes — |            | — million tonnes — |            |
| 1949-50 | 1.230              | 50.2       | 1.222              | 49.8       |
| 1954-55 | 1.312              | 52.2       | 1.203              | 47.8       |
| 1959-60 | 1.279              | 51.4       | 1.208              | 48.6       |
| 1964-65 | 1.032              | 42.5       | 1.342              | 57.5       |
| 1969-70 | 0.808              | 32.8       | 1.657              | 67.2       |
| 1973-74 | 0.683              | 29.7       | 1.619              | 70.3       |
| 1974-75 | 0.754              | 31.1       | 1.666              | 68.9       |

Source: Statistics Canada, Grain Trade of Canada.

**TABLE 4. NUMBER OF FLOUR MILLS IN CANADA IN SELECTED YEARS**

| Year | Number of Mills |
|------|-----------------|
| 1907 | 454             |
| 1908 | 602             |
| 1917 | 615             |
| 1919 | 715             |
| 1922 | 801             |
| 1930 | 503             |
| 1932 | 502             |
| 1945 | 468             |
| 1948 | 399             |
| 1953 | 168             |
| 1959 | 67              |
| 1965 | 57              |
| 1969 | 51              |
| 1971 | 45              |
| 1976 | 41              |

Source: The Northwestern Miller (As reported by the Canadian International Grains Institute); 1975 Statistics Canada.

Canadian millers purchase wheat from the Canadian Wheat Board and the Ontario Wheat Producers Marketing Board. The prices paid by the millers depend on whether the wheat or flour is to be used in Canada or exported. Once the wheat is purchased, the pricing of the flour is a straightforward commercial consideration. The wheat boards are not involved in flour sales. Apart from the two-price wheat program, there are no federal government measures directly and exclusively affecting the milling industry. Some flour is exported as food aid in programs of the Canadian International Development Agency. Insofar as the two-price wheat program assists in maintaining bread consumption, the milling industry is assisted in maintaining its volume of operation.

### Types of Wheat Used

More than 80 percent of the wheat milled for flour in Canada is Canada Western Red Spring, with 1.96 million

tonnes milled in 1974–75. Ontario winter wheat was 7 percent of millings, .174 million tonnes; durum wheat was 6 percent, .147 million tonnes. The rest — less than 5 percent — was Alberta Red Winter and Alberta Soft White Spring wheats, .117 million tonnes. During the past 10 years, the amount of durum milled has increased from .082 million tonnes to .147 million, and Alberta types from less than .027 million tonnes to more than .109 million. Western Red Spring wheat was down .109 million tonnes from 1964–65, from 87.5 to 81.5 percent of the total.

The milling of Canada Western Red Spring Wheat yields a strong flour with a high water-absorbing capacity. This produces an elastic dough ideal for making bread of high volume and good crumb characteristics. Strong flours have a high gluten (protein) content. Weak flours such as those from Ontario winter wheat are lower in gluten content and less suitable for breadmaking but ideal for cake and biscuit production. Durum wheat is hard and vitreous and is milled into granular semolina that is used for macaroni, spaghetti, lasagna and other pasta products.

### Types of Flour Produced

In 1974–75, millings included 1.3 million tonnes of spring wheat flour, .033 million tonnes of whole wheat and graham flour, 0.16 million tonnes of Ontario winter wheat flour, .11 million tonnes of durum semolina and flour and .15 million tonnes of “lower” and “other” grades of flour.

Most Canadian flour is enriched by the addition of thiamine, riboflavin, niacin and iron. In breadmaking, bakers add to the flour ingredients such as milk, shortening and sweeteners.

The extraction rate or yield of flour from the milling of Canada Western Red Spring Wheat in domestic mills is about 73 percent. The principal by-products are millfeeds, which include bran, shorts and middlings used for livestock feeding. Screenings from the carefully-conducted cleaning process, except for coarse trash or impurities such as ergot, are ground and then mixed with the millfeeds. In 1973–74, the quantity of millfeeds amounted to 598 thousand tonnes or about 26 percent of total millings. In 1974–75, the 648 thousand tonnes of millfeeds constituted about 27 percent of total millings.

### Domestic Consumption

As in other developed countries, the per capita consumption of wheat flour in Canada declined for many

years (Table 5). In the period immediately following 1946–47, total consumption as well as per capita consumption declined. Later, though per capita consumption continued to decline, total consumption increased because of population growth. During the last few years, per capita consumption of flour appears to have levelled off at about 59 kilograms per year. Consumption of bread is estimated to be about 37 kilograms. The number of bakeries has been declining fairly steadily from 2,465 in 1965 to 1,680 in 1974. The number of bakery workers during the same period was greatest in 1970 at 19,129 but declined to 16,486 in 1974. Total bread shipments (including products shipped, sold or delivered) in 1975 amounted to 733 thousand tonnes compared with 726 thousand tonnes in 1974, though there were larger amounts in several earlier years. The value of bread shipments in 1975 was estimated at \$446 million and that of other bakery products at \$361 million. Bread exports in 1975, almost exclusively to the United States, amounted to 2.5 thousand tonnes valued at about \$1.5 million. Biscuits, cookies and other bakery products were exported to a greater number of countries but 95 percent went to the United States. Exports totalled about 27 thousand kilograms valued at \$16.7 million.

**TABLE 5. CANADIAN FLOUR CONSUMPTION, SELECTED YEARS**

| Crop Year       | Total Consumption | Per Capita Consumption |
|-----------------|-------------------|------------------------|
|                 | — tonnes —        | — kg —                 |
| 1946-47         | 1,036,499         | 83.5                   |
| 1950-51         | 997,460           | 70.3                   |
| 1955-56         | 1,044,180         | 65.8                   |
| 1960-61         | 1,122,653         | 62.1                   |
| 1965-66         | 1,225,166         | 61.7                   |
| 1970-71         | 1,263,268         | 58.5                   |
| 1973 (Calendar) | 1,301,823         | 59.0                   |
| 1974 (Calendar) | 1,347,183         | 59.9                   |

Source: Statistics Canada, Apparent Per Capita Domestic Disappearance of Food in Canada, Cat. No. 32–226.

The domestic consumer of flour has been protected from high and fluctuating international wheat prices since 1973 by what is known as the two-price wheat policy of the federal government. Under its provisions, the price to millers for wheat to be milled for domestic human consumption is set at \$119.42 per tonne basis No. 1 Canada Western Red Spring, 13.5 percent protein, in store at Thunder Bay. The federal government pays the Canadian Wheat Board the difference between \$119.42 per tonne and the world price, to a maximum world price of \$183.72 per tonne.

## WORLD FLOUR PRODUCTION

The U.S.S.R. is by far the largest producer of flour, with about four times the production of the United States (Table 6). Four EEC countries — Italy, France, the United Kingdom and Germany — are also major producers. Canada is a relatively small producer and, in fact, its production is usually lower than several countries not shown in the table including Egypt, Poland, Brazil and India.

## World Trade in Flour

World trade in flour is a small and declining part of world trade in wheat and flour combined. Exports of flour in terms of wheat equivalent have fallen from about 12 percent of total wheat and flour trade a few years ago to about 8 percent in recent years. While wheat and flour exports have exceeded 60 million tonnes each year since 1972–73, world flour exports have not reached 6 million tonnes since 1969–70 and have fallen about 20 percent since then.

Flour exports have been concentrated among a few countries principally Canada, the United States, the EEC, Australia and recently the U.S.S.R. (Table 7). In the early 1950s Canada was the largest exporter with more than 31 percent of world trade. The United States was close behind, followed by Australia, while the major countries of the current EEC group had only about 10 percent of the total. From 1955–56 to 1964–65 the United States obtained the largest share of world trade with its large PL 480 (food aid) shipments. The EEC countries, largely through their export subsidies, also increased their share quite sharply, ranking second with more than 22 percent of total trade. At the same time exports from Canada and Australia declined in importance with Canada having less than 16 percent in the early 1960s. From 1965–66 to 1974–75 the EEC became the dominant exporter, with the U.S. share falling substantially, and there were further decreases in the Canadian and Australian shares. In 1975–76 the EEC had 53 percent of total flour exports and the United States had less than 17 percent. Canada with 13 percent and Australia with 6.3 percent were relatively unchanged.

Exports from Western Europe in 1950–51 were 366,000 tonnes and in 1974–75 EEC flour exports were 2.5 million tonnes.

## CANADIAN EXPORTS

Exports of Canadian flour in terms of wheat equivalent reached a peak in the 1946–47 crop year at about 2.07

TABLE 6. FLOUR PRODUCTION, MAIN COUNTRIES, 1960-75, CALENDAR YEARS

| Country             | 1960   | 1965   | 1966   | 1967   | 1968   | 1969   | 1970   | 1971   | 1972   | 1973   | 1974   |
|---------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| — thousand tonnes — |        |        |        |        |        |        |        |        |        |        |        |
| U.S.S.R.            | 34,525 | 36,575 | 38,733 | 38,532 | 39,093 | 39,338 | 42,348 | 42,937 | 43,912 | 43,200 | n.a.   |
| U.S.A.              | 11,573 | 11,357 | 11,976 | 11,124 | 11,530 | 11,526 | 11,480 | 11,331 | 11,360 | 11,307 | 10,908 |
| Italy               | 6,002  | 6,313  | 6,353  | 6,370  | 6,340  | 6,360  | 6,474  | 6,610  | 6,711  | 7,103  | 6,859  |
| Turkey              | n.a.   | n.a.   | n.a.   | n.a.   | 5,175  | 5,300  | 5,430  | 5,560  | 5,700  | 6,674  | 7,020  |
| France              | 4,212  | 4,255  | 4,098  | 4,101  | 3,822  | 3,545  | 3,500  | 3,376  | 3,354  | 3,358  | 3,150  |
| U.K.                | 3,752  | 3,734  | 3,703  | 3,703  | 3,685  | 3,747  | 3,756  | 3,780  | 3,690  | 3,766  | 3,751  |
| Germany             | 3,446  | 3,221  | 3,184  | 3,209  | 2,883  | 2,895  | 2,943  | 2,946  | 2,860  | 2,948  | 2,935  |
| Iran                |        | 3,169  | 3,248  | 4,000  | 3,610  | 3,772  | 3,919  | 3,404  | 3,788  | n.a.   | n.a.   |
| Japan               | 2,371  | 2,977  | 3,234  | 3,294  | 3,357  | 3,390  | 3,402  | 3,463  | 3,584  | 3,572  | 3,732  |
| Spain               | 2,812  | 3,186  | 3,091  | 3,352  | 3,279  | 3,224  | 3,186  | 2,971  | 3,055  | 3,095  | 3,024  |
| Romania             | 1,861  | 2,423  | 2,465  | 2,390  | 2,404  | 2,490  | 2,468  | 2,039  | 2,489  | n.a.   | n.a.   |
| Argentina           | 2,213  | 2,240  | 2,136  | 2,161  | 2,207  | 2,190  | 2,347  | 2,389  | 2,427  | 2,298  | 2,460  |
| Canada              | 1,814  | 1,892  | 1,922  | 1,730  | 1,709  | 1,737  | 1,801  | 1,747  | 1,745  | 1,685  | 1,704  |

n.a. — not available.

Source: International Wheat Council, World Wheat Statistics.

TABLE 7. FLOUR EXPORTS MAIN COUNTRIES, FIVE-YEAR AVERAGES 1950-51 TO 1974-75 AND 1975-76

| Country*            | 1950-51       |               | 1955-56       |               | 1960-61       |               | 1965-66       |               | 1970-71       |               |         |               |
|---------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------|---------------|
|                     | to<br>1954-55 | % of<br>total | to<br>1959-60 | % of<br>total | to<br>1964-65 | % of<br>total | to<br>1969-70 | % of<br>total | to<br>1974-75 | % of<br>total | 1975-76 | % of<br>total |
| — thousand tonnes — |               |               |               |               |               |               |               |               |               |               |         |               |
| Australia           | 980           | 22.2          | 727           | 13.5          | 777           | 12.2          | 489           | 8.7           | 284           | 5.4           | 299     | 6.3           |
| Canada              | 1,380         | 37.3          | 1,012         | 18.8          | 1,003         | 15.7          | 888           | 15.7          | 602           | 11.4          | 612     | 13.0          |
| EEC                 | 420           | 9.5           | 1,235         | 22.9          | 1,438         | 22.5          | 1,744         | 30.9          | 2,557         | 48.3          | 2,506   | 53.0          |
| U.S.                | 1,300         | 29.5          | 2,034         | 37.8          | 2,644         | 41.4          | 1,732         | 30.7          | 1,111         | 21.0          | 790     | 16.7          |
| U.S.S.R.            |               |               |               |               |               |               |               |               | 422           | 8.0           | 250     | 5.3           |
| Other               | 332           | 7.5           | 375           | 7.0           | 530           | 8.3           | 795           | 14.1          | 320           | 6.0           | 268     | 5.7           |

\*EEC-9 exports from February 1, 1973; data for earlier years based on main exporting countries eventually making up

EEC group but some small part of EEC exports contained under "Other", U.S.S.R. exports also contained under "Other" in early years.

Source: International Wheat Council.

million tonnes. For about 10 years after the end of the war, exports remained at relatively high levels, but with the development of milling facilities in many former importing countries exports started to fall. The downward trend was broken only in 1963-64 by the special requirements of the U.S.S.R. whose crop failure resulted in large purchases of Canadian wheat and flour. In 1974-75, Canadian exports of wheat flour were the equivalent of about .52 million tonnes, only a quarter of the level in the peak year. Canada's decreased flour exports are partially due to competition from the aforementioned subsidized exports of other countries, particularly the EEC. Canada's exports could increase, however, depending on the results of the current GATT negotiations.

In the early post-war period the principal importer of Canadian flour was the United Kingdom, which took about 45 percent of Canadian exports. Other Commonwealth countries, principally Caribbean countries and India, took about 17 percent. Other European importers included the Netherlands and Norway, which together took more than 10 percent. The main other country of significance at that time was China with more than 8 percent. Smaller importers included Egypt, the Philippines, Brazil and Venezuela. The main importer of Canadian flour in recent years has been Cuba, which took about 75 percent of Canada's exports in 1974-75 (Table 8). Shipments to Cuba result from purchases by the U.S.S.R. grain agency Exportkhleb. Flour trade from Canada to the United Kingdom fell off very

**TABLE 8. MAIN COUNTRIES RECEIVING CANADIAN WHEAT FLOUR, SELECTED YEARS**

| Country                             | 1954-55 | 1964-65 | 1973-74 | 1974-75 |
|-------------------------------------|---------|---------|---------|---------|
| — million tonnes wheat equivalent — |         |         |         |         |
| United Kingdom                      | 0.344   | 0.266   | 0.005   | 0.004   |
| Philippines                         | 0.175   | 0       | 0       | —       |
| Venezuela                           | 0.117   | 0       | —       | 0       |
| Trinidad & Tobago                   | 0.056   | 0.041   | 0.006   | 0.004   |
| Jamaica                             | 0.040   | 0.045   | 0.005   | 0.005   |
| Leeward & Windward                  | 0.030   | 0.028   | 0.019   | 0.019   |
| Cuba                                | 0.025   | 0.180   | 0.371   | 0.380   |
| Japan                               | 0.024   | 0.001   | 0       | 0       |
| Hong Kong                           | 0.024   | 0.019   | 0.005   | 0.004   |
| United States                       | 0.021   | 0.028   | 0.003   | 0.010   |
| Ghana                               | —       | 0.047   | —       | —       |
| U.S.S.R.                            | —       | 0.037   | —       | —       |
| Costa Rica                          | 0.014   | 0.025   | —       | —       |
| French Africa                       | —       | —       | 0.012   | 0.025   |

Source: Statistics Canada, Grain Trade of Canada.

sharply in the mid-sixties and has diminished to the point where the United Kingdom has become a very minor importer. Imports of Canadian flour by other Western European, African and Asian countries have also declined to very low levels. In Africa, the United Arab Republic took the equivalent of .03 million tonnes in

1972-73, but virtually nothing the next two years. In 1975-76, Canadian exports will likely exceed those of 1974-75 because of increases to the Asian countries of Sri Lanka, Korea and Vietnam.

Most of the Canadian flour exported is milled from Western Canadian Hard Spring wheat purchased from the Canadian Wheat Board. Millers also purchase wheat from the Ontario Wheat Producers Marketing Board but very little of this flour is exported.

## OUTLOOK

The outlook for expansion of the Canadian flour milling industry is not optimistic. The world export trade in flour is not likely to increase significantly because countries needing flour will choose to import grain and strive for self-sufficiency in flour production. Competition for whatever flour export market remains will be extremely keen between Canada, the United States, Australia and the EEC.

The consumer subsidy for wheat milled for domestic human consumption may have slowed the decline in domestic per capita consumption; however, a turn-around with a significant increase in per capita consumption is not likely. Growth in the domestic flour market will be the result of population growth.

# BEEF AND PORK OUTLOOK FOR 1977-81

*H.B. Huff\**

Long-term forecasts are essential tools for rational planning in the livestock and meat industry. This note presents a five-year (1977-81) forecast for beef and pork using results from econometric models, which quantify economic principles and biological relationships using historical information.<sup>1</sup>

## OUTLOOK FOR CATTLE AND BEEF

Beef cow numbers, which started to decline in late 1975, are projected to continue decreasing until 1978, as cow-calf producers react to low feeder calf prices. A dramatic improvement in calf prices starting in 1978 is expected to cause increases in beef cow inventories in the 1979-81 period.

The decline in cow slaughter, which started in the second half of 1976, is anticipated to continue at a modest rate in 1977 and 1978 on account of lower herd size, improvements in the dairy sector and small increases in calf prices. In 1979 a sharp decline in cow slaughter is projected as the cow herd build-up accelerates. By 1981 the rate of the build-up is expected to decline and this coupled with a larger herd may cause an increase in cow slaughter.

Steer and heifer slaughter is expected to drop sharply in 1978 and 1979 as a result of a smaller breeding herd and thus fewer calves born, as well as the large holdback of heifers to rebuild the cow herd. A small increase in slaughter is forecast for 1981. Declining grain prices will help to accelerate this process.

Total inspected cattle slaughter in 1980 may be 20 percent below 1976 levels before starting to increase in 1981.

Carcass weights are expected to be slightly lower in 1977 and then increase during the 1978-80 period, reaching a plateau 6-8 percent above 1976 levels.

Per capita beef consumption is projected to decline sharply in 1978 and 1979 before increasing modestly in 1980 and again in 1981.

Beef prices are projected to rise in the 1977-81 period as supplies will be substantially below current levels, while demand will continue to increase 5 to 8 percent annually. The largest price increases are expected in 1978 and 1979. Feeder calf prices are expected to rise significantly following higher slaughter steer prices, reduced grain prices, a reduced number of calves born and an increased demand for heifers for breeding purposes. The projected 1980 price is \$68 per cwt. for A1, A2 steers and \$70 for 400-500 pound steer calves in Toronto.<sup>2</sup>

## OUTLOOK FOR HOGS AND PORK

The upturn in hog production, which started in the third quarter of 1976, was in response to the very high pork prices from the third quarter of 1975 to the third quarter of 1976, and generally falling feed grain prices since the third quarter of 1975. Based on historical relationships, production can be expected to increase until at least the first quarter of 1978. The major uncertainty is the extent to which production is likely to increase in Western Canada. Historically, hog production in the Prairies has moved more in concert with the level of farm-stored grain stocks than with hog or feed grain prices. Feed grain stocks were down 22 percent on July 31, 1976 from one year earlier and may be even lower next year. Wheat stocks, however, are forecast to increase 50 percent by July, 1977. It appears that grain stocks are unlikely to be built to the levels of the early 1970s and this coupled with the Western Grain Stabilization Act will likely result in less livestock finishing in Western Canada.

Lower hog prices from the fourth quarter of 1976 should cause about a 7-percent decline in hog production in 1978. The resulting higher projected hog prices, increasing farm stocks of grain and slightly lower feed prices in 1978 are expected to cause a sizeable increase in hog production (16 percent) for 1979 followed by marginal increases in 1980 and 1981.

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<sup>1</sup> These results are summarized from the author's presentation at the federal-provincial Agricultural Outlook Conference, Ottawa, December 14, 1976. The author received considerable assistance from T.G. MacAulay and M. Spearin in the development of these forecasts.

<sup>2</sup> In constant dollars (i.e., today's purchasing power) this price would be \$54 per cwt. for steers and \$56 per cwt. for calves.

Total Canadian pork production during the 1976-81 period is not expected to reach the level of 1971-75. This is particularly important in Western Canada on account of the projected lower grain stocks and the increased stability of grain producers' incomes.

A growth of 3 to 4 percent per year in the demand for pork is expected as a result of higher population and per-capita income. In addition, substantial increases are anticipated in 1978 and 1979 arising from projected increases in beef prices.

Canada is likely to remain a net importer of pork, probably of about 30 to 40 million pounds per quarter.

**TABLE 1. PROJECTIONS OF BEEF AND PORK PRICES, 1977-81, BASIS TORONTO (\$/CWT.)**

|      | A1, A2 Steers | 400-500 lb.<br>Calves | Index 100<br>Hogs |
|------|---------------|-----------------------|-------------------|
| 1976 | 42            | 40                    | 64                |
| 1977 | 47            | 39                    | 52                |
| 1978 | 57            | 50                    | 68                |
| 1979 | 65            | 62                    | 60                |
| 1980 | 67            | 70                    | 63                |
| 1981 | 68            | 70                    | 64                |

Source: Economics Branch projections.

Taking into account these supply and demand factors and the likely extent of pork trade, price projections were developed. It is expected pork prices will decline about 20 percent in 1977 followed by a sharp increase in 1978 to \$68 per cwt. For the 1979-81 period, prices are anticipated to be in the low \$60 range. If the inflation rate continues at 5 percent per year, prices for 1979-81 in 1976 dollars will be approximately \$50 per cwt.

Combining the outlook for beef and pork, it is projected that red meat consumption should rise in 1977 with slightly lower prices. Consumption should drop sharply in 1978 with substantially higher beef and pork prices. From 1979 through 1981 prices and consumption are projected to increase slowly.

A note of caution about these forecasts is in order. They are based on historical experiences and it cannot be guaranteed such behaviour will continue. Long-term forecasting for the livestock sector is handicapped by the uncertainty of the extent and nature of the external "shocks" the sector will receive. Deviations from expectations in feed grain prices and the growth of the general economy could modify the forecasts substantially in the latter part of the period. These forecasts will be revised periodically as additional market data become available.

**TABLE 2. PROJECTIONS OF BEEF AND PORK MARKETINGS, 1977-81**

|      | Beef Cows<br>on Farms <sup>a</sup> | Cow and<br>Bull<br>Slaughter <sup>b</sup> | Steer and<br>Heifer<br>Slaughter <sup>b</sup> | Total Beef<br>Slaughter <sup>b</sup> | Pork<br>Production |
|------|------------------------------------|---|---|--------------------------------------|--------------------|
|      |                                    | — '000 head —                             |   |                                      | — million lbs. —   |
| 1976 | 4,101                              | 831                                       | 2,775   | 3,606                                | 998                |
| 1977 | 3,795                              | 814                                       | 2,775   | 3,589                                | 1,085              |
| 1978 | 3,714                              | 776                                       | 2,468   | 3,244                                | 1,009              |
| 1979 | 3,714                              | 661                                       | 2,243   | 2,904                                | 1,172              |
| 1980 | 3,937                              | 648                                       | 2,249   | 2,897                                | 1,184              |
| 1981 | 4,212                              | 657                                       | 2,361   | 3,018                                | 1,197              |
| 1982 | 4,465                              |   |   |                                      |                    |

<sup>a</sup>Jan. 1 numbers.

<sup>b</sup>Inspected slaughter.

Source: Economics Branch projections.

# LEGISLATION

## PLANT QUARANTINE ACT

### New regulations effective December 1, 1976

The Plant Quarantine Act of 1969 replaced the Destructive Insect and Pest Act of 1952. Its purpose is to prevent the introduction or spread of pests injurious to plants — that is, to any plant material, whether used for food or decoration, from grain and root crops to ornamental shrubs. The desired effect of the Act is to reduce the cost of plant production and benefit the producer in three main ways: directly, through reduction of losses; indirectly through elimination of expensive treatment of crops; and through improving our export position by being able to assure overseas customers that the crops they want to buy are certified free of pests.

The essential prohibition of the Act states that “no person shall knowingly introduce or admit into Canada, spread within Canada or convey within or from Canada

any pest or any plant or other matter that is infested or likely to be infested with a pest . . . .”

The recently-passed regulations under the Act (Canada Gazette December 8, 1976) concern the application of these provisions. Under the Act the Governor in Council may make regulations prescribing the places at which plants or other related material may be brought into Canada — establishing treatment centres and quarantine stations through which plants may be admitted — prescribing treatment or destruction of infected plants — restricting sale of infested plants — awarding compensation for losses incurred — requiring notification of discovery of a pest — and setting the fees charged for inspection and treatment. The regulations cover in more specific terms the requirements for permits to bring plants into Canada, the means of treatment, the methods of inspection, permission to move infested material within or from Canada, use of infested premises, compensation, health certification, detention of infested material, forfeiture and confiscation, and fees for incidental services. Specific details are set out in the five Schedules under the Act which are printed in the Canada Gazette of December 8.

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## PROGRAMS AND POLICIES

### COW-CALF STABILIZATION

Agriculture Minister Eugene Whelan announced, early in the year, details of an estimated \$70 million federal cow-calf stabilization program for 1977. The program will support 1977 calf prices at 90 percent of the national average of the past five years for good grade calves, with a provision for indexing for cost changes. The September–December period will be used to calculate the five-year average since that is the time when most of the calves are marketed.

The assumed average calf weight is 450 pounds. Producers must have at least five cows to be eligible. They may register up to 100 cows, with the first five being deductible. A farmer with 100 cows would receive a payment on 95 (the maximum), while a farmer with 10 cows would get a payment for five. The program also assumes an 85-percent calf crop and that a farmer will hold 15 percent of his calves for herd replacements, leaving him a 70-percent payment on his eligible herd.

Producers do not have to sell their calves to get a federal payment. Some producers normally hold their calves to sell as yearlings or raise them to market weight; the program will not interfere with these practices. Payments will be based on the number of eligible cows.

Mr. Whelan said the program was a major effort in equalizing cow-calf support levels across the country, providing federal-provincial co-operation and a major step toward a uniform national program. The federal program will cover cow-calf producers in provinces where there are no provincial stabilization programs. In provinces where existing programs continue into 1977, it will cover producers not enrolled in provincial plans. In any province where stabilization levels are lower than the national support level in 1977, payments will be made to bring all producers up to the national level.

Eligible farmers must apply for the federal stabilization program. Registration forms will be available in early March. Cows that have been bred for 1977 calving and

are on farms as of April 1, 1977 will be eligible for payment.

## **BEEF AND VEAL IMPORTS**

Imports of fresh, chilled and frozen beef and veal into Canada will be allowed up to a maximum of 144.75 million pounds in 1977. This includes 24.75 million pounds from the United States, 59.35 million pounds from Australia and 60.65 million pounds from New Zealand. These levels include products held in storage in Canada as a result of over-quota shipments which were in transit from Australia and New Zealand on October 18, 1976. Imports from these three countries totalled 190 million pounds in 1976.

The trend in imports will be closely monitored and if required, action will be taken to ensure the levels are not exceeded. If necessary, the products will be placed under individual import permit control.

On the export side, Canada is expected to ship about 75 million pounds of product to the United States in 1977.

## **BLUETONGUE QUARANTINE LIFTED**

Mr. Whelan announced on January 13 the lifting of the bluetongue quarantine program in southern British Columbia. The Minister said that the lifting will mean improved marketing opportunities for cattle ranchers affected by the quarantine.

The quarantine was imposed in June, 1976 under the provisions of the Animal Contagious Diseases Act and Regulations, and placed restrictions on the movement of cattle and sheep out of the quarantine area. The outbreak in British Columbia was the only case of the disease in Canada and affected livestock and semen exports to a number of countries. Veterinary officials were concerned that the disease, normally more serious in sheep, could become virulent if allowed to spread in the Canadian cattle population.

More than 37,000 bluetongue tests were conducted in the area in 1976, with 1,418 cattle slaughtered in 151 herds and \$545,000 in compensation paid to farmers. A deficiency payment program was announced in September to compensate ranchers for lower cattle prices they might have received as a result of the quarantine. The payments are now being calculated and will be made soon.

## **ASSISTANCE FOR WESTERN RAPESEED**

Transport Minister Lang announced late in 1976 that the

federal government would help to protect rapeseed producers against impending increases in freight rates. A total of \$500,000 would be made available for the balance of the fiscal year ending March 31, and an additional \$2 million for next year. Six prairie rapeseed crushing plants would be compensated for potential increases in freight rates on rapeseed products under new tariffs expected to be published by the Canadian Transport Commission.

## **ADDITIONAL SUBSIDY PAYMENTS TO DAIRY FARMERS**

In December the Canadian Dairy Commission was authorized by Agriculture Minister Whelan to change the method of making subsidy payments to producers of industrial milk. Since milk production had been brought into line with domestic needs, application of monthly market share quotas would be discontinued. Beginning with payments on October deliveries, subsidies were to be paid on all shipments falling within 95 percent of annual subsidy eligibility. This would give dairy farmers \$12 million over the \$19 million being paid on October shipments. The remaining five percent would be added to the final payments in March 1977.

## **WESTERN POTATO CROP SUPPORTED**

Mr. Whelan announced in October that, because of low prices suffered by western producers of table potatoes, the 1976 crop would be designated for support under the Agricultural Stabilization Act. This would assure western producers of returns in line with their costs of production.

## **GRAIN AGREEMENT WITH POLAND**

A new three-year grain agreement between Canada and Poland was signed late in 1976 by Transport Minister Lang and Polish trade officials. Negotiated through the Canadian Wheat Board, the deal calls for Canada to supply and Poland to purchase between 750,000 and 1.2 million tonnes of bread wheat, Durum wheat, barley and oats in the 1977-79 period. Poland has purchased substantial quantities of Canadian grains since 1956 and entered into long-term agreements with Canada in 1963, 1966 and 1973. The latest agreement is a continuation of the previous one, although for larger maximum quantities.

## **NEW CROP PROJECTS FUNDED**

Two groups in Western Canada will receive assistance under the government's New Crop Development Fund.

Agriculture Minister Whelan announced in December that the Palliser Wheat Growers' Association in Regina, and A.A. Kroeker and Sons, Ltd., Winkler, Manitoba, would receive federal assistance totalling \$16,666. The Regina

group will be assisted in collecting data on performance of utility wheats and production methods. The Winkler group will be assisted in producing, harvesting and storing Jerusalem artichoke tubers for seed processing.

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## PUBLICATIONS

### ECONOMICS BRANCH, AGRICULTURE CANADA

*Available from the Publications Manager, Room 303, Sir John Carling Building, Ottawa, Ontario, K1A 0C5.*

**Market Commentary (Outlook): Horticulture and Special Crops.** December 1976. 97 pages. Tables and figures. Papers on the outlook for major horticultural crops and "special" crops such as tobacco, sugar beets, beans, peas and honey.

**Market Commentary (Outlook): Animals and Animal Products.** December 1976. 75 pages. Tables and figures. Papers on the outlook for beef, pork, poultry and eggs, sheep and lambs, and dairy.

**Market Commentary (Outlook): Grains and Oilseeds.** December 1976. 51 pages. Tables and figures. Papers on the outlook for wheat, feed grains and oilseeds.

**Market Commentary (Outlook): Canadian Agricultural Outlook Conference Report.** 96 pages. Tables and figures. Contains various addresses given at the conference including long-term outlook for beef and hog production and prices, and the outlook for farm inputs and farm income.

**Farm Business Summary, Saskatchewan-Manitoba, 1975.** 54 pages. Tables. Contains income, expenses, equities and other data on 115 Manitoba and Saskatchewan grain

and beef cattle farms. Publ. No. 76/18.

### AGRICULTURE CANADA

*Available from the Information Division, Agriculture Canada, Ottawa, Ontario, K1A 0C7.*

**Agricultural Lands in Southern Quebec.** Paul Lajoie. 64 pages plus maps. Publ. No. 1556.

### STATISTICS CANADA

*Available from Publishing Centre, Printing and Publishing, Supply and Services Canada, Ottawa, K1A 0S9.*

**Greenhouse Industry, 1974 and 1975.** Ottawa, 1976. 36 p. Tables, charts. Paper cover, bilingual. Cat. No. CS22-202/1975. \$1.05 per copy.

**Tobacco and Tobacco Products Statistics.** Quarterly. Ottawa. Vol. 43, No. 3, July-September, 1976. Paper cover, bilingual. Cat. No. CS32-014. 70 ¢ per copy.

### SCIENCE COUNCIL OF CANADA

**Food Production in the Canadian Environment.** Barbara J. Geno and Larry M. Geno. 1976. 71 p. Illus., tables, figures, graphs, maps. Paper cover. Available from Supply and Services Canada — see address above. Cat. No. SS21-3/3-1976. \$2.25 (Canada), \$2.80 (other countries).

## IN REPLY

Mrs. Amanda Robinson, a librarian with Wood Gundy Limited of Toronto, wrote saying she uses Canadian Farm Economics as a source of useful, up-to-date statistics and articles for the company's analysts involved in food processing, retailing, farm machinery, fertilizers and agriculture in general. She said it's also useful for their economists and commodity traders. She found the October '76 article on food expenditure patterns useful for reference purposes.

Mrs. Robinson's detailed comments are quoted as follows: "In the investment business, up-to-date information is required, which is why I attempt to scan large numbers of dull government periodicals. The occasional good article is worth the trouble involved in view of the time taken by the government to produce collections of statistics. I also find the list of publications useful. Since so much is published by the government which never finds its way into the 'Daily Checklist', any source of information on current government research or publications is a godsend."

R.S. Butler, Professor, Western College of Veterinary Medicine, University of Saskatchewan (Saskatoon)

found G.C. Retson's August '76 article on Maritime livestock markets useful. He suggested that there could have been some reference in the article to the risk of disease spread in auction markets and some discussion on disease control. He added that he reads articles that are of special interest to him and maintains a file of relevant material.

R.G. Moore, Supply and Services Canada, said he found the October '76 article on food expenditure patterns useful in his unit's role in food procurement for government departments. He said it was the first issue of Canadian Farm Economics he had seen and asked to have his name placed on the mailing list. Mr. Moore is head of Product Planning (Food), Drug and Textile Products Centre.

Mr. Gérard Bélair, an economist with a Quebec grocery chain, gave a high rating to Danielle Karamchandani's October article on changes in food expenditure patterns. He explained that it provided a useful information base to the members of his company. Mr. Bélair added that he appreciated our note on the federal beef inquiry, also in the October issue.



John McConnell, Managing Editor, Canadian Farm Economics,  
Information Division,  
Agriculture Canada, Sir John Carling Building,  
OTTAWA, Ontario,  
Canada,  
K1A 0C5



## CONVERSION FACTORS FOR METRIC SYSTEM

| Imperial units         | Approximate<br>conversion factor     | Results in:                          |
|------------------------|--------------------------------------|--------------------------------------|
| <b>LINEAR</b>          |                                      |                                      |
| inch                   | x 25                                 | millimetre (mm)                      |
| foot                   | x 30                                 | centimetre (cm)                      |
| yard                   | x 0.9                                | metre (m)                            |
| mile                   | x 1.6                                | kilometre (km)                       |
| <b>AREA</b>            |                                      |                                      |
| square inch            | x 6.5                                | square centimetre (cm <sup>2</sup> ) |
| square foot            | x 0.09                               | square metre (m <sup>2</sup> )       |
| acre                   | x 0.40                               | hectare (ha)                         |
| <b>VOLUME</b>          |                                      |                                      |
| cubic inch             | x 16                                 | cubic centimetre (cm <sup>3</sup> )  |
| cubic foot             | x 28                                 | cubic decimetre (dm <sup>3</sup> )   |
| cubic yard             | x 0.8                                | cubic metre (m <sup>3</sup> )        |
| fluid ounce            | x 28                                 | millilitre (ml)                      |
| pint                   | x 0.57                               | litre (ℓ)                            |
| quart                  | x 1.1                                | litre (ℓ)                            |
| gallon                 | x 4.5                                | litre (ℓ)                            |
| <b>WEIGHT</b>          |                                      |                                      |
| ounce                  | x 28                                 | gram (g)                             |
| pound                  | x 0.45                               | kilogram (kg)                        |
| short ton (2000 lb)    | x 0.9                                | tonne (t)                            |
| <b>TEMPERATURE</b>     |                                      |                                      |
| degrees Fahrenheit     | (° F-32) x 0.56<br>or (° F-32) x 5/9 | degrees Celsius (° C)                |
| <b>PRESSURE</b>        |                                      |                                      |
| pounds per square inch | x 6.9                                | kilopascal (kPa)                     |
| <b>POWER</b>           |                                      |                                      |
| horsepower             | x 746<br>x 0.75                      | watt (W)<br>kilowatt (kW)            |
| <b>SPEED</b>           |                                      |                                      |
| feet per second        | x 0.30                               | metres per second (m/s)              |
| miles per hour         | x 1.6                                | kilometres per hour (km/h)           |
| <b>AGRICULTURE</b>     |                                      |                                      |
| gallons per acre       | x 11.23                              | litres per hectare (ℓ/ha)            |
| quarts per acre        | x 2.8                                | litres per hectare (ℓ/ha)            |
| pints per acre         | x 1.4                                | litres per hectare (ℓ/ha)            |
| fluid ounces per acre  | x 70                                 | millilitres per hectare (ml/ha)      |
| tons per acre          | x 2.24                               | tonnes per hectare (t/ha)            |
| pounds per acre        | x 1.12                               | kilograms per hectare (kg/ha)        |
| ounces per acre        | x 70                                 | grams per hectare (g/ha)             |
| plants per acre        | x 2.47                               | plants per hectare (plants/ha)       |

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# CANADIAN FARM ECONOMICS



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Agriculture  
Canada

HON. EUGENE WHELAN, MINISTER — GAÉTAN LUSSIER, DEPUTY MINISTER

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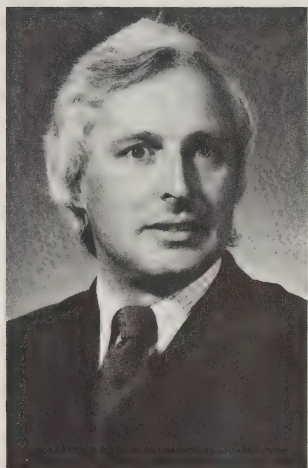
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# HORIZONTAL INTEGRATION IN AGRICULTURAL PRODUCTION



B.H. Davey\*

*Horizontal integration is common in European agriculture. In Western Europe, it is a voluntary phenomenon while in Eastern Europe it is more an integral part of government policy. It is not so common in Canada.*

## INTRODUCTION

This article discusses integration in agriculture, in particular integration in farm production as opposed to integration in the processing and distribution of agricultural products.

The article begins by reviewing some concepts and definitions of integration in agriculture. It then describes various forms of farm integration, drawing primarily on examples from Eastern and Western Europe. This leads to a general review of the advantages and disadvantages of integration for farmers. This review focuses on the micro-economic effects of integration — the effects at the level of the individual farm firm. Finally, a possible role for integration in agricultural production in Canada is sketched.

## CONCEPTS OF INTEGRATION

In general terms, economic integration can be defined as a system of links established between different economic

units<sup>1</sup>, resulting in some degree of economic interdependence. Integration can take place between firms at the same stage in the production and marketing process or between firms at different stages in the process. Hence it is useful to distinguish between horizontal and vertical integration.

Horizontal integration occurs where two or more firms in the same business or at the same stage in the economic process fuse or establish informal or formal ties linking their activities. An example of horizontal integration in primary agricultural production would be the case where two farmers agree to form a co-ordinated dairy operation, with one farmer specializing in milk production and the other in the rearing of replacement stock. Another example is the integrated sow-weanling and feeder-pig operation.

Vertical integration, strictly defined, occurs when a single firm undertakes successive stages in the production process of a particular food or commodity. In agriculture, this could occur when a feed-manufacturing firm produces poultry, slaughters, processes and packages the birds, and distributes the final product to retail outlets. Vertical integration, by definition, always includes two or more successive phases in the production or marketing process.

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\*At time of writing, B.H. Davey was Assistant Director, Farm and Rural Development Division, Economics Branch, Agriculture Canada, Ottawa. He is now Senior Policy Analyst, Food Policy Unit, Department of Consumer and Corporate Affairs, Ottawa.

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<sup>1</sup>In a private-enterprise economy, "economic units" are commonly referred to as "business firms" or simply as "firms".

## HORIZONTAL INTEGRATION IN EUROPE

This section presents some examples of farm-level co-operation in production in Europe. It is not intended to be a comprehensive review.

While joint farming, or complete farm mergers, are comparatively rare in Western Europe, there are several types of integration at the farm level. One is concerned with the co-operative use of farm machinery. In Norway, for example, machinery co-operatives have been organized to make it possible for small farms to benefit from technological innovations. In this case, a small number of farmers jointly purchase and operate a piece of machinery. An alternative is the system of farm machinery banks, the joint use of machinery owned by individual farmers. These banks are found not only in Norway but in many other countries such as Finland, where the joint use of farm machinery by farming neighbors is common.

The objective of the machinery banks is to achieve an efficient use of machinery through an organized exchange of machines, resulting in lower costs on the member farms. In essence, a machinery bank permits farmers to rent their machines to one another. The machines continue to be individually owned. The rental rates are fixed annually by the members, who provide information on the machines they can offer for hire as well as the machines they wish to hire themselves. The enterprise is supervised by a manager or middleman. His job is to list the information provided by the members, facilitate contacts between them and generally coordinate the activities of the bank.

A second type of horizontal integration is designed to encourage greater specialization at the farm level. The basic idea is for each member of a group of farms to specialize in that part of the production process for which he is best qualified, in order to make more efficient and effective use of the total resources of the group. In Finland, for example, so-called "production rings" have been applied in the dairy sector. A ring composed of about six farms sees most of the farms specializing in milk production, while the rest concentrate on the raising of replacement stock for the milking herd and for slaughter. In the typical case, the farms remain in individual ownership. The milk producer sells his calves to the replacement cattle rearer at three to four weeks of age. The heifers are returned to the milk producer about a month before calving. Terms are agreed in advance, with the calves and heifers being transferred at market, or market-related, prices. The male cattle are sold by the rearer on the open market.

An important advantage of this agreement for the milk producer is that not only is he able to specialize but he is also assured of a reliable supply of healthy replacement stock. The risk of "buying disease" onto the farm is greatly reduced. Similar arrangements have been developed in the United Kingdom, for example in the beef and hog sectors, where formal ties have been forged between farms specializing in the rearing of young stock on the one hand and the feeding of animals to slaughter weights on the other.

Co-operative dairy barns represent a move toward a more complete integration of production at the farm level. This is much less common, although some examples may be found in the Scandinavian countries, involving in particular younger farmers who seem more able to adapt to the obligations and limitations associated with joint-farming enterprises. The concept in a co-operative dairy barn is for three or four farmers to group together to build a large, modern dairy barn to replace small, obsolete milksheds. This permits the use of modern technology and the achievement of economies of size in milk production. It can also have impacts in labor use, for example by providing the farmers with more leisure time. The contribution of each farmer may be based on the number of cows he owns or each may contribute an equal share with the profits divided accordingly. The farm land remains under individual ownership.

Other examples of integration in Western European agriculture include the co-operative use of land, primarily pasture, and new systems of employing hired labor especially in dairying. The latter, for example, are aimed at providing relief milking, to give the farmer more leisure time. The examples cited here, while they do not represent a comprehensive review, serve to give the flavor of farm-level co-operation in Western Europe and to provide a basis for comparison with the system in Eastern Europe.

Farm integration has been growing in importance in Eastern Europe in recent years. But whereas farm integration in Western Europe is a voluntary phenomenon, initiated by individual farmers as a means of solving certain perceived problems, it is a much more deliberate process in East European countries. In particular, the achievement of better farm-level integration is very much an integral part of government policy for agriculture since integration is regarded as an important means of achieving greater specialization and concentration, and hence improved productivity and efficiency.

As the following examples will show, the forms of farm integration are not unlike those of Western Europe in

many cases. The differences lie in the general acceptance of integration as a means of solving farm-level problems, in the scale on which many integration activities are carried out, and in the common ownership of factors of production.

In the Byelorussian S.S.R. (White Russia) inter-farm co-operation occurs between collective and state farms. In one instance, two state farms have been co-operating in pork production for several years, with one farm breeding 12,000 pigs a year for fattening on the second farm. In other examples, one farm breeds, and a second fattens, cattle; one farm grows seed for use on the other farms in the association. In cases such as these, common production and co-ordination plans are developed for the participating farms. In essence, these arrangements are similar to the production-ring idea described above.

Hungary is a country where farm integration has come to the fore recently. Inter-farm co-operation through horizontal integration is being promoted to increase labor productivity, increase production of major agricultural products, improve the supply of materials and machinery and apply up-to-date methods of work organization. Typically, a set of partner farms establishes a co-operative organization within a particular branch of production, independent from the farms. The partner farms, including an integrator at the centre of the system, have equal rights in the organization. For example, in poultry and egg production, one may find centralized breeding and hatching activities, with production carried out on the partner farms. As well as taking responsibility for co-ordinating the whole enterprise, the central farm will also undertake feed mixing, supply feed and equipment to the partner farms and offer an extension or advisory service.

Unlike the U.S.S.R., Hungary and Bulgaria, Yugoslavia does not have a highly-socialized, large-scale agriculture. Eighty-five percent of the cultivated land in Yugoslavia remains in small, private farms. Nevertheless, co-operation occurs between the large social-agricultural organizations and the private farms, with the former supplying the latter with machinery services, inputs and advice. This is seen as a means of achieving the benefits of large-scale production, together with specialization and intensification in production. In livestock production, for example, the small farmers may be provided with feed and high-quality breeding stock, or with young stock for fattening. To achieve economies of scale in production and management, orchards and vineyards may be planted on a single piece of land owned by many small farmers; the farmer will supply the land and labor, with machinery, equipment, nursery stock, fertilizers, etc., provided by the co-operative.

In summary, the integration of farm production has become increasingly widespread in Eastern Europe. But the trend is to go beyond horizontal integration of primary production through the formation of huge agro-industrial complexes. These organizations build vertical ties through the addition of processing industries to the primary production activities. The trend seems to be toward complete vertical integration of the food system from the primary through to the tertiary activities.

## Advantages and Disadvantages of Farm Integration

The following discussion of the benefits and problems of farm-level integration is restricted to a review of economic and technical factors. Little or no reference is made to the social aspects often mentioned in discussions of agricultural co-operation.

### Advantages

In general, the economic impacts of horizontal integration in agricultural production are very similar to the effects that can be achieved on specialized farms through an increase in crop acreages or livestock numbers. More particularly, as enterprise size increases with specialization on the individual farm through integration, economies of size (i.e., lower average costs) can be achieved as one moves down to the asymptotic or flat portion of the long-run average-cost curve (Figure 1).

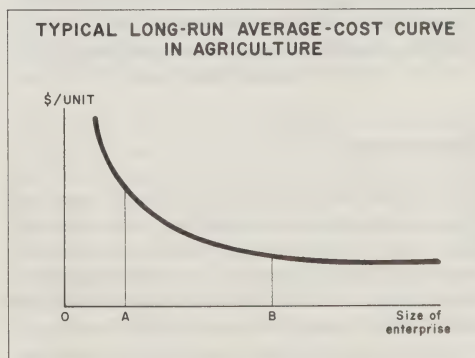


Figure 1

Substantial cost reductions can be achieved by increasing the size of enterprise from OA to OB, but beyond B further cost reductions are minimal. Indeed, a point may eventually be reached where costs will increase with increasing enterprise size.

Some of the more specific benefits of farm-level integration are the following, although it must be recognized that very few, if any, of these benefits are specific to integrated forms of economic activity:

- Machinery banks or co-operative use of machinery can reduce farm equipment costs and ensure more efficient use of machinery.
- Labor costs can be reduced in milk production, pig breeding and pig fattening as herd size is increased through co-operation to reach the maximum size of enterprise that can be handled by one person.
- Some reduction in input costs may be possible through bulk buying and the negotiation of discounts with suppliers.
- On-farm feed mixing can be undertaken on an optimum scale.
- By the integration of livestock-rearing with milk production or the fattening of animals for slaughter, the milk producer or feeder can be assured of a reliable supply of quality livestock, while the rearer is assured of an outlet for his production.
- Working conditions may be improved. In particular, if relief labor is available, the farmer may be able to reduce the burden of his farm work, enabling him to enjoy increased leisure time.
- The overall profitability of farming operations may be increased if they are carried out jointly. One example from Finland will illustrate the point: in a production ring comprising two dairy farms and one replacement-stock farm, the total gross margin increased over 30 percent compared with the situation that existed when the three farms were operated independently.

## Disadvantages

On the other hand, there are certain problems and difficulties associated with integration at the farm level. These must not be overlooked. On the contrary, they must be weighed very carefully by any group of farmers contemplating the establishment of an integrated farming operation. The problems include the following:

- Government policy and programs for agriculture may be geared to the individual proprietor. Farmers who enter into co-operative agreements with one another may find themselves no longer eligible for certain programs or find the benefits greatly reduced from what they were when the farms were operated individually.

- In machinery banks, problems sometimes arise in regard to timing. This can be readily visualized by imagining the situation that can arise when several farmers require the use of a specialized machine at the same time, e.g., when climatic or other conditions are optimal for the operation that machine is designed to perform.
- When farm machinery is used to capacity, the lack of reserve capacity could result in reduced yields if harvest conditions are poor.
- Other losses in technical performance with increasing scale of enterprise may include the following:
  - fewer pigs weaned per litter
  - poorer feed conversion
  - greater risk of livestock diseases and epidemics.
- Greater risks may be involved as farms become more specialized, as the ability to "balance" income on multi-product farms is lost.
- There is a need for a clear agreement among the partners in advance, e.g., in regard to the use and pricing of inputs.
- Major changes in human relationships are required. The farmers must be prepared to relinquish at least part of their independence and work closely with other farmers. This requires that the partners be compatible with one another.
- A higher level of farm management may be required, necessitating the use of specialized skills, such as in organization and administration.

It is not the purpose of this discussion to conclude that farm-level integration is a "good" or "bad" thing. Quite clearly, there are both advantages and disadvantages. The important point is that all the relevant factors should be considered prior to entering into a co-operative arrangement, regardless of the reasons for the arrangement.

## INTEGRATION IN CANADA

Interest in production co-operatives in Canada is limited. Only 318 production co-operatives were reported in 1974<sup>2</sup>. These were primarily livestock-feeding groups in Alberta and Saskatchewan and lumber and pulpwood operations in Quebec. The artificial insemination co-operatives found throughout Canada are also included. In addition, there are a few other co-operative farming enterprises in Saskatchewan.

<sup>2</sup> Sullivan, J.M. Co-operation in Canada, 1974. Economics Branch, Agriculture Canada, Publication No. 76/4, June 1976.

Within the last year or so, an interest has developed in farm machinery banks, particularly in the Maritimes, but, generally speaking, machinery sharing through syndicate arrangements has not been particularly widespread in Canada. Under the Farm Syndicates Credit Act, the Farm Credit Corporation can make loans to syndicates of three or more farmers for the joint purchase of machinery, buildings and equipment. Between 1965 and 1975, 1,068 syndicates were formed and 1,623 loans made. The loans were used to purchase 629 tractors, 810 harvesting machines, 896 tillage implements, 684 pieces of feeding and storage equipment and 1,402 specialized and miscellaneous machines<sup>3</sup>. By comparison there were almost 600,000 tractors and 163,000 combine harvesters on Canadian farms in 1971<sup>4</sup>. One may conclude that formal sharing arrangements for farm machinery are not common in Canada; there are, of course, many informal arrangements in existence, especially among relatives and neighbors.

## REASONS FOR LACK OF INTEREST

A number of reasons may be advanced to explain this lack of interest in horizontal integration among farms. One would undoubtedly be the high value placed on independence by the Canadian farmer. He may be quite unwilling to relinquish the freedom of action to manage his farming activities. Second, Canadian farms are typically much larger than European farms, so there may be less need, for example, to share machinery in the interests of more efficient machinery use. In addition, given the vagaries of the Canadian climate, farmers may be quite willing to carry a reserve of machinery capacity to guard against difficult planting or harvesting conditions; indeed, it may be a necessity. Finally, farmers may be deterred to some extent by agricultural program regulations and eligibility criteria that discriminate against co-operative farming ventures. For example, there is some concern that eligibility criteria for stabilization programs may be impeding a move toward the joint use of machinery and other resources, including land.

A related factor is the popularity of custom work in various parts of Canada. Many farmers, unable to justify economically the ownership of large, expensive machinery that they may use only briefly during the year, take

advantage of custom services offered by other farmers or specialized operators. To some extent this practice can be viewed as a form of integration, in the sense that it accomplishes somewhat the same objectives as formally-integrated systems.

## STRUCTURAL CHANGE

Structural change has been a major feature of Canadian agriculture in the post-war period. The industry has been going through a period of continuous adjustment in response to socio-economic forces. In particular, farms have become fewer and larger in order to obtain the benefits of economies of size, e.g., in the use of machinery, and to make the most effective use of modern agricultural technology. Associated with this trend has been the decline or disappearance of many small rural communities, which many consider to be an undesirable side effect.

Farm-level integration — itself a form of structural organization different from the traditional sole proprietorship — may offer an alternative to the traditional processes of structural change for some farmers. For example, small farmers might give more consideration to the sharing of specialized farm machinery such as harvesting equipment. This would permit the achievement of economies of size and more efficient use of machinery. Over-capitalization or over-capacity in machinery complements on individual small farms would be avoided, such as in the case of the farmer with a \$30,000 combine to harvest 100 acres of grain. The forging of more formal links between livestock rearers and feeders or between cattle rearers and dairy farmers could lead to greater specialization in production, improved productivity and lower costs.

Moves such as these could contribute to an improved competitive position for some Canadian farmers and help to counter the pressures on the small family farm. But there would be a price to pay. The farmers who participate in such arrangements would have to give up some of their treasured independence. It has to be recognized, therefore, that the farmers who choose to work together are those who see personal benefits from doing so. These co-operative arrangements will be maintained only so long as the benefits are perceived to be greater than those attainable on an individual basis.

## SUMMARY

Horizontal integration, the collective action of two or more business firms at the same stage in the economic process, is relatively common in European agriculture.

<sup>3</sup>Federal Farm Credit Statistics, 1975. Farm Credit Corporation. Tables 7 and 8.

<sup>4</sup>Daviault, R. Selected Agricultural Statistics for Canada. Table 26. Economics Branch, Agriculture Canada. Publication No. 76/10. June 1976.

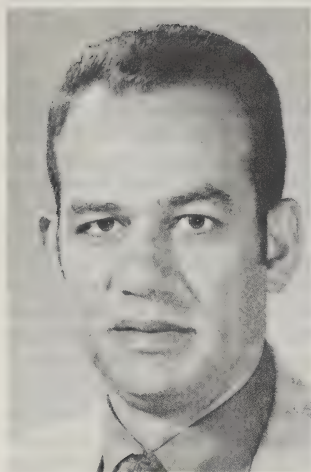
The most common types are those involving machinery and livestock. Farms enter into co-operative agreements to reduce costs through efficient use of machinery. They also operate together in dairying, where some farms concentrate on milk production and the others on raising replacement stock. Another common example is a hog enterprise, where one segment produces the weanling pigs and the other finishes the pigs to market weight.

Farm integration in Western Europe is a voluntary phenomenon, initiated by individuals as a means of solving certain perceived problems. It is, however, a more deliberate process in Eastern Europe. There it is an integral part of government policy for agriculture, since integration is regarded as an important means of

achieving greater specialization, and hence improved productivity and efficiency.

Integration is not common in Canada, for several reasons. One is the high value the Canadian farmer places on independence. Second, farms are larger than in Europe, perhaps lessening the need for sharing machinery in the interests of efficiency. Third, the vagaries of the climate make it desirable, if not imperative, for farmers to carry a reserve of machinery to guard against difficult conditions at planting and harvest times. Fourth, the eligibility criteria of some agricultural programs may discriminate against co-operative farming ventures. Finally, the availability and popularity of custom work reduces the need for farmers to enter into integration arrangements.

# THE DEMAND FOR MAJOR FOODS IN CANADA



*This paper, a synopsis of a major report by the same authors, provides estimates of consumer demand for 27 food commodity groups. Specifically, it explains how consumption of a commodity is affected by changes in its price, in the prices of other commodities, and in the level of income. The information will be of particular interest to economists, university students and others who have had some exposure to economics. Attempts have been made as often as possible, however, to explain concepts and define terms for the benefit of all readers. In this way, the paper serves as both a communication channel and an educational vehicle.*



*Zuhair A. Hassan and S.R. Johnson\**

## INTRODUCTION

It has become increasingly apparent that effective policies for agriculture require a comprehensive view of the industry. Such policies, whether private or public, must account for interrelationships within the agricultural sector as well as the functional role of the industry in the economic system. For Canada, this aspect of policy analysis is even more crucial because of the importance of its agriculture in international trade. Policies that fail to incorporate these interrelationships adequately may be highly sensitive to the changing nature of the industry and the economy. Consequently, they may require continual up-dating and revision and, correspondingly, unnecessarily high adjustment costs and uncertainty for agents in the agricultural sector.

Consumer demand for food is an obvious and important component of the economic structure within which the agricultural sector must operate. Since the demand for

food is, in general, unresponsive to price changes and since the production and supply of agricultural commodities is somewhat variable, accurate estimates of demand relationships are important inputs in the development of national price stabilization, trade, storage and production control policies. These policies in turn affect the decision-making of farm operators and other micro-units in the food and agricultural sector.

This paper reports the results of a major study designed to provide estimates of consumer demand for food commodity groups in Canada (Hassan and Johnson [1976]). Estimates of the demand structure for 27 food commodity groups and a non-food group are presented. The purpose of these estimates is to explain consumer behavior in the market place — that is, to explain what commodities consumers will purchase and in what quantities, and how consumers can be expected to respond to changes in commodity prices and income.

## DEMAND FUNCTIONS

According to the theory of consumer behavior, individuals or households arrange purchases of goods and services so as to maximize satisfaction (utility), subject to limited money income. Given this assumption,

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demand functions can be easily derived<sup>1</sup>. These demand functions show that the amount of a particular commodity an individual will purchase is related to the price of the commodity in question, prices of other commodities and income. For example, a consumer deciding on the purchase of beef might well consider its price in relation to prices of other meats, other foods, and more generally, prices of non-food items, as well as his income.

Demand theory suggests an inverse (negative) relationship between the quantity demanded of a product and its (own) price. This relationship – called a **direct-price effect** – means that an increase in the price of the commodity results in a decrease in the quantity purchased, with other factors remaining constant.

Relationships between the quantity demanded of one product and the prices of other products may be positive, negative, or zero. This is called a **cross-price effect**. Relationships are expected to be positive for rival (substitute) products like beef and pork – for example, an increase in pork prices can be expected to result in an increase in beef consumption. For co-operating (complementary) products like bread and butter the relationship is likely to be negative – an increase in the price of one will trigger a decrease in demand for the other. For independent products like salt and tea the relationship is expected to be zero, meaning that the price of one does not affect the demand for the other.

Finally, an increase in income will affect demand. A positive **income effect** is expected for a product considered superior (beef), meaning that more of the product will be purchased, while a negative income effect is associated with a good considered inferior (lard)<sup>2</sup>.

To apply these theoretical results, it is assumed that the individual consumer is “representative” of an aggregate group. This assumption is necessitated by the fact that most of the data required for estimating the demand functions are available only in aggregate form. In addition it is assumed that other factors (e.g., tastes, age,

composition of household, habits, etc.) affecting consumption remain constant or change sufficiently slowly that they can be omitted from the analysis. Finally, it is often presumed that prices of other commodities not closely related to the one in question can be omitted from the demand function, because their effects on observed consumption levels are not systematic.

Recently, this latter assumption, implicit in most applied demand analyses, has come under increased attention (Brandow [1961] and George and King [1971])<sup>3</sup>. The contention has been that consumer demands for food commodities are so highly interrelated that the use of estimated demand functions that consider only income, direct (own) price and perhaps the price of another related commodity give results that are too simplified for accurate policy analysis. But this observation has brought with it a dilemma. The theory indicates that all prices are important. Yet, the data series on which the estimates for the demand systems are based are much too short to permit statistical estimation of the required parameters. The compromise made in approaching the food demand estimation problem has been one of estimating the basic or important parameters, i.e., parameters for direct price, income and selected cross-price effects, and then using restrictions<sup>4</sup> following from the consumer demand theory to generate the remaining cross-price effects (Brandow [1971], George and King [1971], Hassan and Johnson [1976]). The restrictions following from the theory of consumer demand are included in the resulting demand system and hence, they are not exploited for their possible information content in the estimation of the basic parameters from the sample data.

## ESTIMATION METHOD

Parameter estimates used in constructing the full demand system are direct-price elasticities of demand, selected cross-price elasticities, income elasticities<sup>5</sup> and expenditure proportions<sup>6</sup>. The estimated price and

<sup>1</sup> In mathematical notation these demand functions can be written as:

$$q_i = f_i(P_1, P_2, \dots, P_i, \dots, P_n, m) \quad i = 1, \dots, n$$

where  $q_i$  is the quantity of the (ith) commodity,  $P_i$  is the price of the (ith) commodity and  $m$  is consumer income.

<sup>2</sup> The terms ‘superior’ and ‘inferior’ do not refer to the nutritional value or the quality of the product but refer to the sign of the income coefficient.

<sup>3</sup> The rest of this section plus the section “Estimation Method” may be of interest only to economists. Other readers may wish to proceed directly to the section “The Full Demand System for Food”.

<sup>4</sup> For a detailed treatment of these restrictions (Engel, Cournot, Symmetry and Homogeneity) see Hassan and Johnson [1976, p. 8].

<sup>5</sup> The various elasticity concepts will be defined in the next section.

<sup>6</sup> Expenditure proportion = expenditure for a particular commodity as a proportion of total expenditure. In Table 2, these proportions are in decimal form. To convert to percentages, multiply by 100.

TABLE 1. DIRECT PRICE AND INCOME ELASTICITIES

| Commodity            | Direct-Price Elasticity | Commodity            | Income Elasticity |
|----------------------|-------------------------|----------------------|-------------------|
| - Elastic -          |                         | - Superior -         |                   |
| Veal                 | -2.59                   | Lamb                 | 0.68              |
| Lamb                 | -1.87                   | Frozen Foods         | 0.54              |
| Turkey               | -1.09                   | Cheese               | 0.52              |
| Frozen Foods         | -1.03                   | Turkey               | 0.52              |
|                      |                         | Veal                 | 0.51              |
|                      |                         | Beef                 | 0.51              |
| - Inelastic -        |                         | Canned Fruits        | 0.40              |
| Shortening           | -0.97                   | Prepared Foods       | 0.33              |
| Pork                 | -0.95                   | Salad Dressing       | 0.30              |
| Salad Dressing       | -0.93                   | Butter               | 0.29              |
| Cheese               | -0.91                   | Fresh Fruits         | 0.23              |
| Butter               | -0.86                   | Shortening           | 0.22              |
| Beef                 | -0.85                   | Fish                 | 0.22              |
| Fish                 | -0.80                   | Fluid Milk           | 0.21              |
| Canned Fruits        | -0.75                   | Cereals              | 0.16              |
| Prepared Foods       | -0.67                   | Beverages            | 0.15              |
| Margarine            | -0.63                   | Chicken              | 0.15              |
| Chicken              | -0.56                   | Pork                 | 0.13              |
| Lard                 | -0.46                   | Sugar                | 0.12              |
| Fresh Fruits         | -0.45                   | Other Dairy Products | 0.11              |
| Fluid Milk           | -0.44                   | Canned Vegetables    | 0.11              |
| Beverages            | -0.37                   | Margarine            | 0.10              |
| Other Dairy Products | -0.33                   | Fresh Vegetables     | 0.09              |
| Canned Vegetables    | -0.32                   | Miscellaneous Foods  | 0.04              |
| Fresh Vegetables     | -0.24                   | Eggs                 | 0.0               |
| Sugar                | -0.24                   | Skim Milk Powder     | 0.0               |
| Cereals              | -0.20                   |                      |                   |
| Skim Milk Powder     | -0.19                   | - Inferior -         |                   |
| Miscellaneous Foods  | -0.12                   |                      |                   |
| Eggs                 | -0.12                   | Lard                 | -0.10             |

income elasticities employed in constructing the system are reported in Table 1. The price elasticity estimates used are from selected time series studies for the Canadian economy. Details relating to these estimates and their relationships to others for the Canadian and U.S. economies are contained in the monograph by Hassan and Johnson [1976]. Income elasticities are from a study (Hassan and Lu [1974]) based on the 1969 *Family Food Expenditure Survey*<sup>7</sup>. In the latter cross-section data, the period of observation is sufficiently short that prices can be presumed constant. Differences in family food consumption patterns can thus be related to income levels.

Restrictions from the theory that are used in the construction of the estimated food demand structure are also detailed in the more extensive report (Hassan and Johnson [1976]). Briefly, these restrictions relate to the

internal consistency of the system with respect to cross-price effects, income elasticities and the assumption that individuals make a basic budget decision on food and non-food expenditures and then proceed from it to select among food commodities.

In summary, although the underlying parameters are estimated from different data sources and by different statistical estimation methods, once they are obtained the rules derived from the theory fix all of the elasticities except those for cross-price effects. There is considerable latitude with the cross-price effects in that a number of them can be prespecified. In past studies this alternative has been used when fairly reliable statistical information has existed on the nature of the cross-price effects.

## THE FULL DEMAND SYSTEM FOR FOOD

The full demand system for food obtained by applying the methods outlined in the preceding section is present-

<sup>7</sup>Statistics Canada, Catalogue No. 62-537.

ed in Table 2. As already indicated, parameter estimates used in constructing the demand matrix are presented in Table 1. Before explaining the various estimated coefficients in the demand matrix, it will be useful to discuss the preliminary statistical results contained in Table 1.

The information shown in Table 1 reveals that:

- All of the estimated direct-price elasticities<sup>8</sup> have the expected negative sign, which demand theory would lead one to expect. That is, an increase in the price of the product results in a decrease in the quantity purchased, other factors remaining unchanged.
- For veal, lamb, turkey, and frozen foods, the percentage change in quantity is greater than the corresponding percentage change in price. This means that the quantity demanded is relatively highly responsive to price changes. In other words, a given change in price will result in a more than proportionate percentage change in the amount purchased.
- In the case of beef, pork, cheese, etc., the percentage change in quantity purchased is less than the corresponding percentage change in price. That is, the quantity demanded exhibits a lower responsiveness to price changes. A change in the price has a smaller effect on the amount purchased than in the case of veal, lamb, turkey and frozen food.
- The demand for other commodities, such as skim milk powder, miscellaneous food and eggs is apparently unresponsive to changes in prices. For example, the ratio of percentage change in quantity to percentage change in price for eggs is .12. This means consumption of eggs drops only .12 percent when the price rises one percent.
- The estimated income elasticities<sup>9</sup> are positive (with only one<sup>10</sup> exception) which implies that all commodity groups are superior.

<sup>8</sup>The direct-price elasticity of demand is a measure of the responsiveness of consumption of a product to changes in its own price. It is simply a ratio that expresses the percentage change in quantity associated with a one-percent change in price. If the direct-price elasticity is greater than one in absolute terms, demand is said to be elastic. If the ratio is less than one in absolute terms, demand is said to be inelastic. The terms thus refer to more and less than proportionate responses in consumption to (own) price changes.

<sup>9</sup>Income elasticity of demand is a measure of the responsiveness of the quantity demanded to changes in income. It is the ratio of the percentage change in quantity purchased to the percentage change in income.

<sup>10</sup>Superior commodities are those with an income elasticity that is positive. Inferior commodities have a negative income elasticity. Commodities with income elasticities between zero and one are considered necessities, while those with elasticities greater than one are defined as luxuries.

- The consumption of superior goods such as beef, cheese, etc., follows response patterns that differ from those for only modestly superior and inferior goods (e.g., lard). On the one hand, the income elasticities for strongly superior goods suggest that consumption of these items increases by a factor of about one half of one percent with a one-percent increase in income. The income elasticity for the inferior good, on the other hand, shows that its consumption decreases with increased income.
- The income elasticities of demand for eggs and skim milk powder indicate that consumption of these commodities is unresponsive to changes in the level of income. Thus, consumers are not likely to increase their consumption of these commodities when their incomes rise.

The demand matrix, Table 2, provides numerical estimates of the effects of changing prices and incomes on the type and amount of food we consume. These results include the income and price elasticities shown in Table 1, as well as the cross-price effects. What the demand matrix adds then is a basis for showing how price, income and consumption are related.

In Table 2, the 27 food commodities, their sum (an all-foods category) and a non-food group are listed. The expenditure proportions are indicated in row 30 and the income elasticities are recorded in column 30. Numerical entries in the main body of the table refer to the commodity names heading the rows and columns in which they are located. To illustrate, in row two, column two, the entry is -0.9547. This is the column and row identified with pork. The entry is the direct-price elasticity, which can be found also in Table 1. The comparability of Tables 1 and 2 can in fact be confirmed by observing that the direct-price elasticities, located in like-identified rows and columns, and the income elasticities, located in column 30, are the same as those shown in Table 1. Other entries in the main body of Table 2 are cross-price elasticities of demand<sup>11</sup>.

Interpretations of the results presented in Table 2 are straightforward. The income and direct-price elasticities of demand can be interpreted as indicated by the discussion of Table 1. The cross-price elasticities simply express the percentage change in the quantity consumed of one commodity resulting from a one-percent change in the price of another. The effect of a 10-percent change in prices can be found simply by multiplying the coefficients by 10.

<sup>11</sup>Cross-price elasticity of demand is a measure of the responsiveness of consumption of a good, say beef, to changes in the price of another commodity, say pork.

TABLE 2. ELASTICITY MATRIX FOR FOOD AND NON-FOOD COMMODITY GROUPS

|                           | Beef<br>1 | Pork<br>2 | Lamb<br>3 | Veal<br>4 | Chicken<br>5 | Turkey<br>6 | Fish<br>7 | Eggs<br>8 | Cereals<br>9 | Milk<br>10 |
|---------------------------|-----------|-----------|-----------|-----------|--------------|-------------|-----------|-----------|--------------|------------|
| 1 Beef                    | -.85220   | .06330    | .09330    | .01108    | .03447       | .00398      | .00762    | .00011    | .00243       | .00597     |
| 2 Pork                    | .10908    | -.95470   | .01621    | .03435    | .03146       | .01086      | .04681    | .01583    | .09833       | .06108     |
| 3 Lamb                    | .40600    | .46502    | -1.86600  | .01404    | .00942       | .00468      | .09343    | .00017    | .01178       | .00616     |
| 4 Veal                    | .26735    | .54290    | .00779    | -2.59300  | .10688       | .04165      | .09354    | .03064    | .01262       | .11642     |
| 5 Chicken                 | .18330    | .10280    | .00149    | .02237    | -.56370      | .00272      | .00432    | .00037    | .00483       | .00619     |
| 6 Turkey                  | .05618    | .09330    | .00164    | .02454    | .00505       | -1.09000    | .02019    | .00409    | .02962       | .02199     |
| 7 Fish                    | .07061    | .24237    | .00206    | .03084    | .00635       | .01192      | -.79290   | .00299    | .02111       | .01598     |
| 8 Eggs                    | .01950    | .05806    | .00059    | .00739    | .00152       | .00286      | .00302    | -.12070   | .00232       | .00422     |
| 9 Cereals                 | .01968    | .06754    | .00057    | .00125    | .00177       | .00332      | .00351    | .00012    | -.20000      | .00645     |
| 10 Milk                   | .02320    | .07963    | .00068    | .01013    | .00209       | .00392      | .00414    | .00014    | .00691       | -.43900    |
| 11 Butter                 | .06676    | .22917    | .00194    | .02916    | .00601       | .01127      | .00540    | .00042    | .01989       | .01485     |
| 12 Cheese                 | .03028    | .10394    | .00088    | .01323    | .00272       | .00511      | .00481    | .00019    | .00902       | .00673     |
| 13 Skim Milk Powder       | .02696    | .00950    | .00079    | .00360    | .00243       | .00455      | .00459    | .00017    | .00803       | .08950     |
| 14 Other Dairy Products   | .02576    | .08842    | .00075    | .01125    | .00232       | .00435      | .01230    | .00016    | .00767       | .00573     |
| 15 Margarine              | .06895    | .00900    | .00201    | .00300    | .00620       | .01164      | .01230    | .00043    | .02054       | .01533     |
| 16 Lard                   | .08349    | .00900    | .00243    | .00300    | .00751       | .01409      | .01489    | .00052    | .02487       | .01857     |
| 17 Shortening             | .01600    | .32429    | .00275    | .04126    | .00850       | .01595      | .01685    | .00059    | .02815       | .02101     |
| 18 Salad Dressing         | .07458    | .25601    | .00217    | .03257    | .00671       | .01259      | .01330    | .00047    | .02222       | .01659     |
| 19 Fresh Fruits           | .02173    | .07460    | .00063    | .00949    | .00195       | .00367      | .00388    | .00014    | .00647       | .00483     |
| 20 Canned Fruits          | .03052    | .10476    | .00089    | .01333    | .00275       | .00515      | .00544    | .00019    | .00909       | .00679     |
| 21 Fresh Vegetables       | .01689    | .05796    | .00049    | .00737    | .00152       | .00285      | .00301    | .00011    | .00503       | .00376     |
| 22 Canned Vegetables      | .02485    | .08529    | .00072    | .01085    | .00224       | .00419      | .00443    | .00016    | .00740       | .00553     |
| 23 Sugar                  | .01500    | .00380    | .00051    | .00210    | .00106       | .00198      | .00209    | .00007    | .00350       | .00261     |
| 24 Beverages              | .02342    | .08038    | .00068    | .01023    | .00211       | .00395      | .00418    | .00015    | .00698       | .00521     |
| 25 Frozen Foods           | .04472    | .15350    | .00130    | .01953    | .00402       | .00755      | .00797    | .00028    | .01332       | .00994     |
| 26 Prepared Foods         | .03280    | .11260    | .00096    | .01433    | .00295       | .00554      | .00585    | .00020    | .00977       | .00730     |
| 27 Other Foods            | .01078    | .03700    | .00031    | .00471    | .00097       | .00182      | .00192    | .00007    | .00321       | .00240     |
| 28 All Food               | -.09646   | -.02085   | -.00285   | -.00406   | -.00694      | -.00693     | -.00588   | -.00158   | -.01605      | -.02201    |
| 29 Non Food               | -.01931   | -.02616   | -.00023   | -.00078   | -.00779      | -.00131     | -.00443   | -.00893   | -.04406      | -.01766    |
| 30 Expenditure Proportion | .03743    | .02491    | .00084    | .00155    | .00759       | .00263      | .00477    | .00720    | .03748       | .01868     |

TABLE 2. ELASTICITY MATRIX FOR FOOD AND NON-FOOD COMMODITY GROUPS — Continued

|                           | Butter<br>11 | Cheese<br>12 | Skim milk powder<br>13 | Other Dairy<br>Products<br>14 | Margarine<br>15 | Lard<br>16 | Shortening<br>17 | Salad Dressing<br>18 | Fresh Fruits<br>19 | Canned<br>Fruits<br>20 |
|---------------------------|--------------|--------------|------------------------|-------------------------------|-----------------|------------|------------------|----------------------|--------------------|------------------------|
| 1 Beef                    | .01036       | .00409       | .00013                 | .00194                        | .00271          | .00030     | .00022           | .00209               | .00368             | .00408                 |
| 2 Pork                    | .06192       | .02264       | .00015                 | .02337                        | .00062          | .00002     | .02003           | .01226               | .03787             | .02569                 |
| 3 Lamb                    | .01267       | .00441       | .00015                 | .00214                        | .00339          | .00039     | .00429           | .00258               | .00367             | .00446                 |
| 4 Veal                    | .12311       | .04242       | .00106                 | .04545                        | .00287          | .00025     | .04025           | .02443               | .07161             | .04877                 |
| 5 Chicken                 | .00615       | .00362       | .00010                 | .00176                        | .00145          | .00014     | .00182           | .00121               | .00409             | .00352                 |
| 6 Turkey                  | .02685       | .00966       | .00071                 | .00826                        | .00755          | .00089     | .00882           | .00536               | .01353             | .01058                 |
| 7 Fish                    | .01699       | .00712       | .00046                 | .00567                        | .00463          | .00052     | .00540           | .00337               | .01006             | .00760                 |
| 8 Eggs                    | .00228       | .00271       | .00001                 | .00088                        | .00001          | —          | .00046           | .00042               | .00299             | .00245                 |
| 9 Cereals                 | .00512       | .00355       | .00010                 | .00179                        | .00114          | .00010     | .00142           | .00099               | .00433             | .00343                 |
| 10 Milk                   | .00580       | .00335       | .00269                 | .00140                        | .00135          | .00013     | .00174           | .00115               | .00341             | .00320                 |
| 11 Butter                 | — .85830     | .00344       | .00007                 | .00141                        | .00595          | .00023     | .00209           | .00134               | .00328             | .00331                 |
| 12 Cheese                 | .00304       | — .90770     | .00017                 | .00240                        | .00310          | .00035     | .00387           | .00236               | .00438             | .00457                 |
| 13 Skim Milk Powder       | .00271       | .00401       | — .19240               | .00244                        | .00149          | .00014     | .00179           | .00123               | .00544             | .00406                 |
| 14 Other Dairy Products   | .00258       | .00383       | .00015                 | — .33000                      | .00138          | .00013     | .00172           | .00116               | .00428             | .00355                 |
| 15 Margarine              | .21220       | .01026       | .00041                 | .00491                        | — .62760        | .00091     | .00896           | .00556               | .01773             | .01238                 |
| 16 Lard                   | .01085       | .01243       | .00049                 | .00595                        | .00955          | — .46280   | .31263           | .00291               | .01144             | .00777                 |
| 17 Shortening             | .00948       | .01406       | .00056                 | .00673                        | .01081          | .03820     | — .96800         | .00662               | .01993             | .01410                 |
| 18 Salad Dressing         | .00748       | .01110       | .00044                 | .00531                        | .00854          | .00039     | .00850           | — .92700             | .00964             | .00751                 |
| 19 Fresh Fruits           | .00218       | .00323       | .00013                 | .00155                        | .00249          | .00011     | .00248           | .00101               | — .45460           | .00336                 |
| 20 Canned Fruits          | .00306       | .00454       | .00018                 | .00217                        | .00349          | .00016     | .00348           | .00141               | .00502             | — .74980               |
| 21 Fresh Vegetables       | .00169       | .00240       | .00010                 | .00120                        | .00193          | .00009     | .00192           | .00078               | .00278             | .00245                 |
| 22 Canned Vegetables      | .00249       | .00370       | .00015                 | .00177                        | .00284          | .00013     | .00283           | .00115               | .00409             | .00361                 |
| 23 Sugar                  | .00118       | .00210       | .00007                 | .00084                        | .00134          | .00006     | .00134           | .00054               | .00193             | .00170                 |
| 24 Beverages              | .00235       | .00349       | .00014                 | .00167                        | .00268          | .00012     | .00267           | .00109               | .00385             | .00340                 |
| 25 Frozen Foods           | .00449       | .00666       | .00026                 | .00319                        | .00512          | .00023     | .00509           | .00207               | .00736             | .00649                 |
| 26 Prepared Foods         | .00329       | .00488       | .00019                 | .00234                        | .00375          | .00017     | .00374           | .00152               | .00540             | .00476                 |
| 27 Other Foods            | .00108       | .00160       | .00006                 | .00077                        | .00123          | .00006     | .00123           | .00050               | .00177             | .00156                 |
| 28 All Food               | — .01031     | — .01313     | — .00013               | — .00485                      | — .00131        | .00005     | — .00191         | .00188               | — .01557           | — .01197               |
| 29 Non Food               | — .00549     | — .00246     | — .00073               | — .00717                      | — .00206        | — .00026   | — .00141         | — .00096             | — .01125           | — .00383               |
| 30 Expenditure Proportion | .00662       | .00497       | .00059                 | .00663                        | .00188          | .00019     | .00153           | .00117               | .01227             | .00574                 |

TABLE 2. ELASTICITY MATRIX FOR FOOD AND NON-FOOD COMMODITY GROUPS — Concluded

|                           | Fresh Vegetables<br>21 | Canned Vegetables<br>22 | Sugar<br>23 | Beverages<br>24 | Frozen Foods<br>25 | Prepared Foods<br>26 | Other Foods<br>27 | All Food<br>28 | Non Food<br>29 | Income<br>30 |
|---------------------------|------------------------|-------------------------|-------------|-----------------|--------------------|----------------------|-------------------|----------------|----------------|--------------|
| 1 Beef                    | .0042                  | .00169                  | .00002      | .00345          | .00413             | .00374               | -.00166           | -.67258        | .16688         | .50570       |
| 2 Pork                    | .02735                 | .02151                  | .00021      | .04080          | .02214             | .02521               | -.01266           | -.17623        | .04373         | .13250       |
| 3 Lamb                    | -.00004                | .00183                  | .00007      | .00360          | .00473             | .00419               | -.00245           | -.89921        | .22311         | .67610       |
| 4 Veal                    | .05192                 | .04176                  | .00147      | .07839          | .04260             | .04845               | .02333            | -.68508        | .16998         | .51510       |
| 5 Chicken                 | .00169                 | .00161                  | .00017      | .00355          | .00309             | .00304               | .00013            | -.19817        | .04917         | .14900       |
| 6 Turkey                  | .00786                 | .00750                  | .00054      | .01432          | .00975             | .01025               | .00191            | -.68907        | .17097         | .51810       |
| 7 Fish                    | .00603                 | .00519                  | .00052      | .01021          | .00671             | .00715               | .00202            | -.28901        | .07171         | .21730       |
| 8 Eggs                    | .00125                 | .00082                  | .00020      | .00220          | .00194             | .00191               | .00041            | -.00000        | 0.00000        | 0.00000      |
| 9 Cereals                 | .00215                 | .00165                  | .00026      | .00372          | .00286             | .00291               | .00070            | -.05958        | .01478         | .04480       |
| 10 Milk                   | .00102                 | .00126                  | .00008      | .00286          | .00291             | .00274               | -.00038           | -.27345        | .06785         | .20560       |
| 11 Butter                 | .00070                 | .00125                  | .00001      | .00279          | .00313             | .00288               | -.00080           | -.38184        | .09474         | .28710       |
| 12 Cheese                 | .00064                 | .00211                  | .00003      | .00423          | .00458             | .00423               | -.00147           | -.69160        | .17160         | .52000       |
| 13 Skim Milk Powder       | .00311                 | .00226                  | .00036      | .00489          | .00332             | .00352               | .00131            | -.00000        | 0.00000        | 0.00000      |
| 14 Other Dairy Products   | .00193                 | .00168                  | .00021      | .00372          | .00306             | .00305               | .00038            | -.14617        | .03627         | .10990       |
| 15 Margarine              | .01216                 | .00961                  | .00112      | .01855          | .01064             | .01188               | .00537            | -.13553        | .03363         | .10190       |
| 16 Lard                   | .00792                 | .00571                  | .00084      | .01141          | .00636             | .00719               | .00398            | .13300         | -.03300        | -.10000      |
| 17 Shortening             | .01350                 | .01101                  | .00119      | .02109          | .01231             | .01365               | .00564            | -.29380        | .07290         | .22090       |
| 18 Salad Dressing         | .00550                 | .00501                  | .00044      | .00982          | .00676             | .00709               | .00150            | -.39474        | .07974         | .29680       |
| 19 Fresh Fruits           | .00109                 | .00137                  | .00008      | .00306          | .00307             | .00290               | -.00041           | -.29952        | .07432         | .22520       |
| 20 Canned Fruits          | .00140                 | .00213                  | .00002      | .00435          | .00427             | .00405               | -.00084           | -.53200        | .13200         | .40000       |
| 21 Fresh Vegetables       | -.24020                | .00063                  | .00010      | .00177          | .00200             | .00185               | -.00017           | -.11970        | .02970         | .09000       |
| 22 Canned Vegetables      | .00097                 | -.32150                 | .00015      | .00273          | .00255             | .00246               | .00006            | -.15628        | .03577         | .10840       |
| 23 Sugar                  | .00046                 | .00054                  | -.24000     | .01547          | .00911             | .01007               | .00047            | -.14417        | .03878         | .11750       |
| 24 Beverages              | .00091                 | .00108                  | .00184      | -.37260         | .00250             | .00234               | -.00029           | -.20549        | .05099         | .15450       |
| 25 Frozen Foods           | .00174                 | .00207                  | .00351      | .00453          | -.103200           | .00520               | -.00103           | -.71288        | .17688         | .53600       |
| 26 Prepared Foods         | .00128                 | .00152                  | .00257      | .00332          | .00398             | -.67100              | -.00092           | -.43891        | .10841         | .32850       |
| 27 Other Foods            | .00042                 | .00050                  | .00085      | .00109          | .00131             | .00103               | -.12440           | -.04748        | .01178         | .03570       |
| 28 All Food               | -.00765                | -.00459                 | -.00118     | -.01180         | -.00917            | -.00936              | -.00352           | -.29188        | .07242         | .21946       |
| 29 Non Food               | -.01330                | -.00686                 | -.00165     | -.01279         | -.00159            | -.00411              | -.01083           | -.21742        | -.10224        | 1.23965      |
| 30 Expenditure Proportion | .01197                 | .00633                  | .00154      | .01256          | .00337             | .00535               | .00912            | .23491         | .76509         | 1.00000      |

As an example of how the results in Table 2 can be used, observe that the entry in row one, column one (beef) shows that a one-percent increase in the price of beef is expected to reduce its estimated consumption by 0.852 percent — a direct-price effect. Alternatively, a one-percent increase in the price of pork is projected to increase beef consumption by 0.063 percent. This estimate is made on the basis of the entry in row one, column two and is a cross-price effect. Relatedly, if non-food prices (clothing, housing, fuel, etc.) increase by one percent, beef consumption is estimated to rise approximately 0.167 percent. This cross-price effect is obtained from the entry in row one, column 29. Finally, from row one, column 30, it is observed that a one-percent increase in consumer income will increase beef consumption 0.506 percent.

Similar exercises can be conducted to obtain the implications of the results in Table 2 for effects of selected price and income changes on estimated consumption levels for each of the commodities. On a more general basis, the results in Table 2 suggest some additional observations. First, from what is called a "homogeneity condition", the effect of a given percentage increase in all prices and income is to leave consumption unchanged. Again, using beef as an example, the results in Table 2 show that a one-percent increase in the prices of beef, of all other foods, of non-foods, and income would have no effect on beef consumption<sup>12</sup>.

Second, the entries in the demand matrix presented in Table 2 show that most of the estimated cross-price elasticities are positive. This implies that consumers generally view food commodities as substitutes (rivals) rather than complements. For example, the cross-price elasticity of demand for beef with respect to the price of pork is .063, i.e., a one-percent increase in the price of pork increases beef consumption by 0.063 percent. Alternatively, the cross-price elasticity of demand for pork with respect to the price of beef is .109. A one-percent increase in the price of beef increases pork consumption by 0.109 percent. These results suggest that changes in beef prices have a much greater effect on pork consumption than changes in pork prices have on beef consumption. Another example is the case of margarine and butter. The table shows that a change in the price of butter has a far greater effect on the consumption of margarine than vice-versa.

In short, the results provided by the demand matrix in Table 2 are generally self-explanatory. The purpose of this discussion has been to demonstrate the importance of such a set of elasticity estimates as a component of a comprehensive food policy. The effects of ignoring these cross-price effects and the interrelationships imposed by such a system may be substantial. This is particularly evident when one considers the relative magnitudes of some of the cross-price elasticity estimates.

## SUMMARY

The purpose of this discussion has been to outline the more detailed development of the final demand matrix for food commodities contained in the report by Hassan and Johnson [1976]. The present discussion has focused on an outline of the construction of the final demand matrix, definitions and applications of some of the standard elasticity concepts and selected implications of the coefficients provided by the estimated demand matrix. The emphasis has been on the cross-price effects provided by the demand matrix. This information, showing the interrelatedness of final demands for agricultural commodities, is the major contribution of the larger study.

The more complete report of these results includes a full theoretical development of the consumer demand theory on which the estimates are based, a collection and comparison of alternatively available estimates for the parameters reported in Table 1, a step-by-step review of the procedures used to construct the final demand matrix and a detailed discussion of policy implications of the estimated matrix. The discussion of policy implications features alternative structures for translating final to farm demand estimates and the derivation of price-flexibility estimates. These flexibility estimates show price changes associated with the supply of different quantities of foods and thus are more directly applicable to many of the standard policy questions for agriculture. It is hoped this abbreviated treatment of the results has served to indicate their importance, provide some of the basic parameter estimates and highlight the potential of the more comprehensive report for private and public policy analysis.

## REFERENCES

- Brandow, G.E., *Interrelationships Among Demands for Farm Products and Implications for Control of Market Supply*, Pennsylvania Agricultural Experiment Station, Bulletin 680, University Park, 1961.

<sup>12</sup>(-0.852 per cent + .180 percent + .167 percent + .506 percent = 0.0 percent).

George, P.S. and G.A. King, Consumer Demand for Food Commodities in the United States with Projections for 1980, Giannini Foundation, Monograph Number 26, University of California, Davis, 1971.

Hassan, Zuhair A. and S.R. Johnson, Consumer Demand for Major Foods in Canada, Agriculture Canada, Economics Branch, Publication No. 76/2, 1976.

# QUEBEC'S DEPENDENCE ON IMPORTED FEED GRAINS: AN HISTORICAL PERSPECTIVE



Jacques Lebeau\*

*Quebec agriculture is depending more and more on imported feed grains because of its weak grain production base and its expanding livestock production. This article traces the history of this growing dependence.*

## INTRODUCTION

One of the main factors contributing to the problems of Quebec farmers is the increase in grain imports and prices. From 1969 to 1973, almost 98 percent of the grain produced in Quebec was used for raising livestock, with the rest going to distilleries. Quebec-produced grain is, therefore, an intermediate product which, like hay, is used almost exclusively as animal feed. Farming in the province is mostly livestock-based and crop production, geared to the livestock sector, is not advanced or given priority the way it is in Western Canada. Quebec farmers, then, do not have the choice Western farmers have — they cannot easily adjust to the swings in the grain market by selling their grain directly when the price is high and marketing it through livestock when the price is low. It is only in a crisis, such as a strike preventing grain shipments, that the economic advantages of self-sufficiency become evident.

Until very recently Quebec's crop production system was traditional. Although a minority of producers use modern techniques, there is still a large area of natural or semi-cultivated grazing land and poorly drained grassland producing well below its potential. Moreover, oats — the

most common feed grain — in addition to being considered as a good source of energy for beef cattle, have also served to a large extent as a cover crop to combat weeds. Naturally, the average yield and the nutritive value of most crops could be greatly improved (Table 1). In short, because the cropping pattern is for the most part extensive, the fertile soil of Quebec is dominated by forages and only a small area is left for growing grain and corn.

Several factors may explain the growing dependence of Quebec farmers on grain from the West and corn from Ontario and the United States. They are as follows:

- the evolution of animal production;
- the integration of hog and poultry production by feed companies;
- the lack of information on the profitability of feed grains;
- the insufficient grain storage capacity.

The scope of this article is limited to an analysis of these factors<sup>1</sup>.

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<sup>1</sup> A subsequent article will suggest solutions to Quebec's problems with regard to self-sufficiency in grain production.

**TABLE 1. CROP PRODUCTION, ACREAGE AND YIELD IN QUEBEC, 1969-1973**

| Item                      | Production <sup>a</sup> | Acreage <sup>a</sup> | Yield per acre | Attainable objectives <sup>d</sup> |
|---------------------------|-------------------------|----------------------|----------------|------------------------------------|
|                           | — tons —                |                      |                | Yield per acre                     |
| Wheat                     | 26,766.0                | 36,760               | 1,456          | 3,000                              |
| Barley                    | 29,884.8                | 38,180               | 1,565          | 3,000                              |
| Oats                      | 457,072.2               | 730,000              | 1,252          | 3,000                              |
| Mixed grains              | 88,691.2                | 118,080              | 1,502          | 3,000                              |
| Total-cereal grains       | 602,414.2               | 923,020              |                |                                    |
| Grain corn <sup>b</sup>   | 225,663.2               | 105,120              | 4,293          | 6,000                              |
| Total-grain               | 828,077.4               | 1,028,140            |                |                                    |
| Corn silage               | 1,599,200.0             | 128,440              | 24,902         | 32,000                             |
| Hay                       | 5,410,000.0             | 2,750,600            | 3,934          | 5,000                              |
| Grazing land <sup>c</sup> |                         | 1,857,400            |                |                                    |
| Total acreage cultivated  |                         | 5,764,580            |                |                                    |

<sup>a</sup>Agricultural statistics, Bureau de la statistique du Québec, 1973-1974. <sup>b</sup>

<sup>b</sup>Includes the quantity consumed by livestock and that sold to distilleries.

<sup>c</sup>Agricultural statistics, Bureau de la statistique du Québec, 1970, 1971, 1972, and 1973-74.

<sup>d</sup>These objectives are lower than those established by biologists. "Les contraintes agronomiques à l'approvisionnement en grain au Québec" (Agricultural constraints on Quebec grain supplies), Dr. F. Gauthier, Agriculture, Vol. 32, No. 2, September 1975

## EVOLUTION OF ANIMAL PRODUCTION, 1941-1973

### Grain Consumption by Livestock

The total amount of grain consumed by livestock in Quebec increased by 58.5 percent from 1941 to 1973 (Table 2). This figure is based on the assumption that only ruminants<sup>2</sup> are fed corn silage whereas other animals are fed only feed grains and grain corn. The increase in grain consumption by ruminants has been only 28.5 percent, less than 1 percent annually. The main reasons for the increase in consumption by ruminants have been the feeding of more grain to dairy cows (related to the improvement in milk yield from 4,052 pounds in 1941 to 6,884 pounds in 1973) and the increased number of beef cattle (from 57,500 cows and steers to 247,000)<sup>3</sup>. Consumption increased most rapidly from 1941 to 1958. During this period the increase was 5.6 times greater than between 1958 and 1973 because of the marked decrease in animal production during the latter period. Contrary to the overall trend, grain consumption by sheep and calves dropped 17.1 percent because these traditional production sectors proved unprofitable.

Landless animal production — hog, poultry and egg production based primarily on purchased feed — has developed at a rapid rate since 1941. As a result, the amount of grain required by this sector has increased 120.8 percent, slightly less than 3.8 percent annually. In contrast to the trend among ruminants, the largest increase in grain consumption by hogs and poultry occurred between 1958 and 1973; it was 1.7 times greater than the increase from 1941 to 1958. By enterprise, the increases were 60.7 percent for hogs, 1,071.3 percent for poultry and 43.4 percent for egg production.

### INTEGRATION OF LANDLESS OPERATIONS BY FEED COMPANIES

The phenomenal development of landless livestock production in Quebec is due in large part to the integration formulas promoted by privately and co-operatively owned feed mills. The degree of integration in each sector is not known precisely, but it is reasonable to state that 70 to 80 percent of the poultry (broiler hens, large roosters, turkeys, and so on) and 40 to 50 percent of the eggs and hogs are produced under integration contracts between the producer and the mill. A wide variety of contracts exists, with provisions ranging from the payment of a lump sum weighted according to an efficiency rate<sup>4</sup> to the placing of the

<sup>2</sup>Dairy cattle, beef cattle and sheep.

<sup>3</sup>Bureau de la statistique du Québec, 1973-1974, page 91, Table 2, June 1, and page 132, Table 42.

<sup>4</sup>Conversion rate of feed consumed per pound liveweight or per dozen eggs.

TABLE 2. ESTIMATED GRAIN CONSUMPTION IN QUEBEC\*

| Type of animal or product   | 1941-1945 | 1956-1960 | 1969-1973 | Self-sufficiency in the finished products <sup>a</sup> |
|-----------------------------|-----------|-----------|-----------|--|
|                             |           | — tons —  |           | — % —  |
| Milk                        | 605,765   | 790,879   | 915,245   | 127.8  |
| Cattle <sup>b</sup>         | 703,382   | 836,752   | 792,392   | 25.0   |
| Calves                      | 49,770    | 52,115    | 44,371    | 155.2  |
| Sheep                       | 4,584     | 2,808     | 674       | 6.1  |
| Sub-total of ruminants      | 1,363,501 | 1,682,554 | 1,752,682 |  |
| Hogs                        | 512,132   | 627,543   | 823,055   | 73.1   |
| Poultry                     | 40,745    | 133,806   | 477,262   | 110.6  |
| Eggs                        | 102,755   | 130,571   | 147,319   | 53.0   |
| Sub-total of monogastrics   | 655,632   | 891,920   | 1,447,636 |  |
| Total estimated consumption | 2,019,133 | 2,574,474 | 3,200,318 |  |

\*For more detailed information on the method of estimating consumption, contact J. Lebeau, Ste-Foy Research Station, Ste-Foy, Québec.

<sup>a</sup>Toward integrated development. Quebec Department of Agriculture.

<sup>b</sup>Includes beef cattle.

producer on salary. These contracts have one, and sometimes two, goals in common: (1) to ensure, through horizontal integration<sup>5</sup>, that the mills produce a given amount of feed and (2) to assure hatcheries, grading stations and abattoirs of a regular supply, through vertical integration<sup>6</sup>.

Although the feed mills must be given credit for the vast increase in the productivity of the landless sector, the result has been a decreased interest by hog and poultry producers in grain production. The grain sold as feed to such producers is purchased outside Quebec because imported grain is often of higher quality. This system is financially advantageous for the mills as they make a gross profit of 18 to 25 percent<sup>7</sup> on the grain. This would not be the case if producers grew their own grain,

as they would then need to pay only milling and mixing costs.

TABLE 3. GRAIN PRODUCTION AND DEGREE OF SELF-SUFFICIENCY

|   | 1941-1945 | 1956-1960 | 1969-1973 |
|---|-----------|-----------|-----------|
|   |           | — tons —  |           |
| Production of corn silage <sup>a</sup>              | 616,000   | 580,000   | 1,599,200 |
| Equivalent in grain corn <sup>b</sup>               | 143,369   | 134,990   | 372,201   |
| Production of grain corn for livestock <sup>c</sup> | —         | —         | 206,726   |
| Production of feed grains in Quebec <sup>a</sup>    | 884,086   | 980,827   | 602,414   |
| Total grain production                              | 1,027,455 | 1,115,817 | 1,181,341 |
| Total estimated consumption                         | 2,019,133 | 2,574,474 | 3,200,318 |
| Total estimated imports                             | 991,678   | 1,458,657 | 2,018,977 |
| Self-sufficiency (percent)                          | 50.9      | 43.3      | 36.9      |

<sup>a</sup>Agricultural statistics, Bureau de la statistique du Québec, 1966 and 1973-1974, page 48, Table 6. Corn silage containing 25 percent dry matter (DM) and 17.9 percent total digestible nutrients (TDN).

<sup>b</sup>The equivalent is calculated on an energy basis (% TDN). One ton of grain corn is equivalent to 4,2966 tons of corn silage. Grain corn contains 85 percent DM and 75 percent TDN.

<sup>c</sup>Production of grain corn consumed by livestock. Total production less the amount sold to distilleries, Bureau de la statistique du Québec, 1973-1974; for grain corn produced in 1969 and sold to distilleries, Bureau de la statistique du Québec 1972.

<sup>5</sup>Horizontal integration: The extension of the decision-making power of one or several enterprises over an activity (for example, mill versus producer).

<sup>6</sup>Vertical integration: The extension of the decision-making power of one enterprise over one or several complementary activities (for example, mill, hatchery, egg-grading station and abattoir versus egg producer).

<sup>7</sup>Gross profit of an establishment is defined as the income received from the sale of products as well as payments received for services performed on goods of other establishments, minus input costs. The input costs considered are those incurred in manufacturing activities, excluding fuel, electricity and labor; included, on the other hand, is the amount paid to the other establishments for services they perform on its products. The range of gross profit quoted is taken from unpublished information from a study, by the Bureau de la statistique du Québec, of establishments whose principal activity is the manufacture and sale of animal feeds.

**TABLE 4. ESTIMATED AVERAGE VALUE OF GRAIN IMPORTS BY QUEBEC, 1969-73**

| Type of grain                  | Average annual subsidized imports<br>(1) | Average grain prices <sup>a</sup><br>(2) | Average value<br>(1) x (2) |
|--------------------------------|--|--|----------------------------|
|                                | — tons —                                 | — \$/ton —                               | — \$ —                     |
| Wheat (60 lb/bu)               | 384,680                                  | 68.68                                    | 26,419,822.40              |
| Oats (34 lb/bu)                | 270,920                                  | 59.78                                    | 16,195,597.60              |
| Barley (48 lb/bu)              | 523,940                                  | 59.63                                    | 31,242,542.20              |
| Ontario grain corn (56 lb/bu)  | 59,236                                   | 60.55                                    | 3,586,739.80               |
| American grain corn (56 lb/bu) | 310,862                                  | 63.53                                    | 19,749,062.86              |
| <b>TOTAL*</b>                  | <b>1,549,638</b>                         |  | <b>97,193,764.86</b>       |

<sup>a</sup>Average prices, including transportation costs, port of Montreal.

\*It follows from this that the feed companies imported \$126 million worth of grain during the 1969-1973 period, estimated as follows:

$$\frac{2,018,977}{1,549,638} \times 97,193,764.86 = \$126,630,840.42.$$

Consequently, the mills encourage the importation of the grain required by the landless sector, resulting in a build-up of unused arable land in Quebec. This results in the producers' being dependent on imported grains and Quebec feed mills.

What this dependence costs producers can be estimated by calculating the minimum amount of income lost. The assumption is that if they grew their own grain, the family income from agriculture would increase by at least the amount of profit the mills make on the grain they sell. Given the mills' average gross profit (23.1 percent), the 1969-1973 consumption profile<sup>8</sup> and grain prices at the port of Montreal, the producers in the landless sector are losing approximately \$21 million annually by not growing their own grain<sup>9</sup> (Table 4). The estimation is made as follows:

$$\frac{2,018,977}{1,549,638} \times 0.717 \times 97,193,764.86 \times 0.231 = \$20,973.313$$

<sup>8</sup>It is assumed that the consumption distribution of the various grains is similar to the distribution of the subsidized grain imports.

<sup>9</sup>On the other hand, if producers feeding ruminants are considered as well, farmers as a whole are losing approximately \$29 million in revenue, estimated as follows:

$$\$126,630,840.42 \times 0.231 = \$29,251,724$$

## Grain Production, 1941-1973

For the purpose of this analysis, Quebec's corn silage production has been converted into its grain corn equivalent. In this way, the overall production of grain in Quebec has been estimated, including feed grains, grain corn consumed by livestock and corn silage.

The introduction of grain corn around 1966 and the increase in corn silage production between 1941 and 1973 (from 129,405 tons to 463,390 tons of grain corn equivalent) have resulted in an overall increase in grain production of 15 percent. During the same period, the production of feed grains decreased by 31.9 percent; however, the introduction of grain corn almost totally compensated for this drop. In fact, grain production has increased significantly in Quebec since 1931. As the general decrease in the amount of land under cultivation has been counterbalanced by an increase in yield, production has been relatively stable over the past 30 or 40 years.

Since grain consumption has risen more rapidly than production, Quebec has had to increase its imports by 104 percent since 1941. This means that the province is now only about 37 percent self-sufficient in grain. If the amount of grain produced in landless operations is disregarded, some 28.3 percent of the grain imported from 1969 to 1973 was consumed by ruminants, with the rest going to the landless sector.

**TABLE 5. QUEBEC'S GRAIN STORAGE CAPACITY**

|  | - bushels -       |
|--|-------------------|
| Elevators <sup>a</sup>   | 38,700,000        |
| Elevators belonging to protein supplement manufacturers <sup>a</sup> | 1,000,000         |
| Mills <sup>a</sup>   | 4,500,000         |
| Country elevators <sup>b</sup>                                       | 36,300,000        |
| <b>TOTAL</b>   | <b>80,500,000</b> |

<sup>a</sup>Le Meunier Québécois, Vol. 10, No. 9, page 20, May 1976.

<sup>b</sup>Total from table 6.

## INSUFFICIENT GRAIN STORAGE CAPACITY

According to the *Meunier Québécois*<sup>10</sup>, the total grain storage capacity in the government sector, private

<sup>10</sup>Y-a-t-il un problème d'entreposage au Québec" (Is there a storage problem in Quebec?) *Meunier Québécois*, Vol. 10, No. 9, page 20, May 1976.

**TABLE 6. GRAIN PRODUCTION IN QUEBEC 1969-1973<sup>a</sup>**

|                         | - bushels -       |
|-------------------------|-------------------|
| Wheat                   | 892,200           |
| Barley                  | 1,245,200         |
| Oats                    | 26,886,600        |
| Mixed grain             | 4,326,400         |
| Grain corn <sup>b</sup> | 2,953,106         |
| <b>TOTAL</b>            | <b>36,303,506</b> |

<sup>a</sup>Agricultural statistics, Bureau de la statistique du Québec, 1973-1974

<sup>b</sup>Grain corn consumed by livestock. Total production less the amount sold to distilleries and mills, Bureau de la statistique du Québec, 1973-1974.

industry and co-operatives is 44.2 million bushels (Table 5). It is presumed that the storage capacity of Quebec's country elevators is equivalent to the average grain production from 1969 to 1973, i.e., 36.3 million bushels (Table 6).

Estimates indicate that Quebec needs a storage capacity of 149.9 million bushels in order to attain complete self-sufficiency in grains. This figure is based on three factors: (1) annual grain production in Quebec in tons (quantity), (2) annual grain production in bushels (volume), (3) annual grain consumption (excluding corn silage in terms of its grain corn equivalent)<sup>11</sup>. From 1969 to 1973, annual grain production was 685,101 tons or 36,303,506 bushels (Table 6). Annual consumption during this period was 2,828,117, tons (Table 3). The storage capacity required, therefore, is as follows:

$$\frac{2,828,117 \times 36,303,506}{685,101} = 149,861,925 \text{ bushels.}$$

Subtracting the current storage capacity of 80.5 million bushels from the figure above, one finds that 69.4 million bushels of storage space is still required.

## LACK OF INFORMATION

One of the best means of encouraging farmers to produce a specific crop is to show its profitability, and to do this, detailed profitability studies are needed. A partial analysis, which has already been done, makes it

possible to draw some conclusions regarding dairy producers<sup>12</sup>. These conclusions and possible solutions to the problems in the grain-production sector will be dealt with in a subsequent article.

## SUMMARY

Quebec producers are somewhat dependent on economic factors and decisions originating outside their province and this dependence increases as imports increase. More important, as a result of their dependence on imported grains and Quebec feed mills, they lose an estimated \$29 million annually.

For 30 years livestock producers have increasingly tended to obtain their grain supplies from outside Quebec. Even though the long-term trend might seem irreversible, the analysis of its causes is the first step toward solving the problems resulting from this dependence.

## BIBLIOGRAPHY

1. Agriculture Canada, Weight and Conversion Factors for Canadian Agricultural Products, September 1962.
2. Ministère de l'Agriculture du Québec, Vers un développement intégré, Direction générale de la commercialisation, 1974.
3. Bureau de la Statistique du Québec, Statistiques agricoles 1966, 1967, 1968, 1969, 1970, 1971, 1972 et 1973-1974.
4. Gauthier, F., "Les contraintes agronomiques à l'approvisionnement en grain au Québec", *Revue Agriculture*, vol. 32, no 2, septembre 1975.
5. Harbec, A., "La rentabilité des éleveurs de campagne est-elle possible au Québec?" Dossier de la Terre de Chez-Nous, vol. XIVII, no 32, 13 octobre 1976.
6. Hénault, M., Approvisionnement et utilisation du maïs-grain au Québec, Service de mise en marché du ministère de l'Agriculture du Québec, 1969, 1970, 1971, 1972-1973 et 1973-1974.
7. Lebeau, J. et collaborateurs, "Production extensive versus production intensive et régionalisation", *Revue Agriculture*, vol. 33 no 1, juin 1976.

<sup>11</sup>Equal weights of different types of grain do not occupy the same volume; it has been assumed, therefore, that the profile of grain consumption by livestock is similar to that for grain produced in Quebec (excluding grain corn) and sold to mills and distilleries.

<sup>12</sup>Production extensive versus production intensive et régionalisation" (Extensive versus intensive production and regionalism), J. Lebeau et al, *Revue Agriculture*, Vol. 33, No. 1, June 1976.

8. "Y-a-t-il un problème d'entreposage au Québec?", Meunier Québécois, vol. 10, no 9, mai 1976.
9. Canadian Livestock Feed Board, annual reports 1969, 1970, 1971, 1972 and 1973.
10. Bureau de la statistique du Québec, Enquêtes sur les manufactures 1969, 1970, 1971, 1972 et 1973. Données non publiées.
11. The World Food Crisis, special section, Time magazine, November 11, 1974.

# STABILIZATION BACKGROUNDER

*This backgrounder, prepared by Sally Sheppard, formerly of Agriculture Canada's Information Division, outlines the purpose and operation of the Agricultural Stabilization Act. The act, passed in 1958, was amended in 1975. Examples of the application of the act since 1975 are given, as well as explanations of how the revised act has benefited farmers through the shorter base period, the higher support level and the provision for indexing to cover increases in cash costs of production.*

Support prices have been set for 17 different agricultural commodities since the Agricultural Stabilization Act was amended in July, 1975.

Support is mandatory under the act for nine named commodities — hogs, cattle, sheep, industrial milk and cream, corn, soybeans, plus oats and barley grown outside the designated Canadian Wheat Board area. Support levels for these products are automatically calculated each year.

In addition to the named commodities, the amended act (ASA-75) provides stabilization for any other agricultural product designated by the Agricultural Stabilization Board when conditions warrant this action. The 1975 crops of six commodities — sweet cherries, summer pears, prune plums, carrots, apples and British Columbia raspberries — were designated for assistance. So far for 1976, only early table potatoes have been designated. In each instance, the support level was calculated in the same way as for named commodities.

In the early 1970s when the groundwork was being laid to update the Stabilization Act, it was felt that producers needed an effective guarantee that they would receive a reasonable return on their labor and capital. Yet, it was necessary to avoid interference in the production and marketing decisions of individual producers. ASA-75 was designed specifically to accomplish these things.

ASA-75 is a price-support program, not an income guarantee. It will keep farmers in business when farm receipts for a particular commodity are low or when input costs have risen at a faster rate than market prices. Although the act does not guarantee farmers a profit, it takes production cost changes into account and normally will provide a support level that is above cash costs of production. Since the formula used to set support levels is directly related to average market prices, farmers are protected when market prices fall suddenly through no fault of their own.

## Determination of Support Level

Under the amended act, the minimum support level for named agricultural commodities is 90 percent of the average market price over the previous five years, plus the difference between current cash costs of production and the average cash costs in the preceding five years.

The formula is based entirely on two major economic factors — what the farmer received for his commodity in the marketplace and what it cost him to produce it.

As a general rule, the government has also agreed to support designated commodities at the same 90-percent minimum level.

While support levels, after successive periods of low market prices, can be below the total cost of production, farmers are generally still guaranteed returns in excess of cash costs. The act specifically provides that other factors may be taken into consideration in prescribing support levels in excess of 90 percent to overcome problems such as this.

## Support Levels Past and Present

Under the old Agricultural Stabilization Act minimum support for certain named commodities was provided at 80 percent of the average market price over the previous 10 years. It was not indexed to take into account changes in costs of production. In the inflationary economy recently experienced, the 10-year average was not representative of current market prices. In the 1970s, average market prices, and more particularly costs of production, have had little similarity to those of the 1960s.

A comparison of support levels under the old and new acts shows that ASA-75 provides a much more realistic support price. For example, the minimum support price for lambs in 1976 was \$46.15 per hundredweight; under the old act, the minimum support level would have been only \$27.37 per hundredweight. The support level for soybeans for the 1975-76 crop year was \$4.35 per bushel but under the old act it would have been \$2.81. The support level for corn during the same period was \$2.11 per bushel and under the old act, at the minimum, this would have been only \$1.35.

## An Example — Hogs

An analysis of how the support level is determined for one commodity under ASA-75 will illustrate how the level is calculated for all commodities. The support level for hogs in 1975-76 is a good example.

The formula used to determine the support price was: 90 percent of the previous five-year average price, plus the difference between current cash costs and the previous five-year average cash costs of production.

The support price for 1975-76 (the hog year runs from April to March) was \$46.44. This price was calculated as follows:

| Year       | National Average<br>price<br>(\$/cwt. of dressed pork) | National Average<br>cash costs |
|------------|--|--------------------------------|
| 1970-71    | \$27.67  | \$17.64                        |
| 1971-72    | 26.08  | 17.76                          |
| 1972-73    | 39.30  | 18.11                          |
| 1973-74    | 52.97  | 28.34                          |
| 1974-75    | 49.57  | 35.43                          |
| 5 yr. avg. | 39.12  | 23.46                          |

90 percent of the 5-year average price: \$35.21

Cash costs 1975-76: \$34.69

Support price 1975-76:  $\$35.21 + (\$34.69 - \$23.46) = \$46.44$  per hundredweight.

There was no payment to hog producers because the national average market price for hogs between April, 1975 and March, 1976 was \$70.02 per hundredweight — well above the support level and the cash costs of production in that year.

Cash costs for the hog support level included feed costs (from prices of feed grains and protein supplement), labor (hired farm labor), insurance on buildings, maintenance and operation (repairs and machine operations), utilities and veterinary and medicine expenses.

The ASA-75 support level outlined here is the minimum 90 percent level set forth in the act. The Agricultural Stabilization Board, which administers ASA-75 under the federal Minister of Agriculture, can recommend support at a higher level when it feels this is justified.

But there is a limit on how high the stabilization level may go. The Agricultural Stabilization Board is careful in administering the act to ensure the support level does not stimulate overproduction, which could disrupt domestic markets or interfere with international trade arrangements.

Under ASA-75, the federal government is not restricted to deficiency payments. The act also allows for stabilization through product-purchase programs and other payments for the benefit of producers. In addition, regional stabilization programs can be set up for commodities that have a regional, as opposed to a national, market. There is provision, as well, for producer and provincial contributions and participation in stabilization programs at levels higher than the support provided by the federal government.

ASA-75 helps farmers to make longer-term production decisions with confidence. It ensures that their returns will not fall below a reasonable level related to past prices and present costs.

Since a deficiency payment is made on an average basis for a marketing period and all eligible producers receive the same rate per unit, the incentive still exists for each producer to achieve the best return he can get from the marketplace during that marketing period.

# SUPPORT LEVELS AND PAYMENTS UNDER THE AMENDED STABILIZATION ACT

| NAMED<br>COMMODITIES   | Marketing<br>Year | Delivery Period<br>Ending | Support<br>Level | Average Market<br>Return | Level of<br>Payment                  |
|------------------------|-------------------|---------------------------|------------------|--------------------------|--------------------------------------|
| Cattle (Beef)          | 1975              | Dec. 31/75*               | \$43.94/cwt      | \$44.20/cwt              | no payment                           |
|                        | 1976              | Dec. 31/76                | \$40.16/cwt      | quarterly                | \$1.84/nii/3.00/2.98cwt              |
| Sheep                  | 1975              | Dec. 31/75                | \$47.70/cwt      | \$53.86/cwt              | no payment                           |
|                        | 1976              | Dec. 31/76                | \$46.15/cwt      | \$47.09/cwt              | no payment                           |
| Milk & Cream           | 1975              | Mar. 31/76                | \$11.02/cwt      |                          | \$2.66/cwt                           |
|                        | 1976              | Mar. 31/77                | \$11.45/cwt      |                          | \$2.66/cwt                           |
| Hogs                   | 1975              | Mar. 31/76                | \$46.44/cwt      | \$70.02/cwt              | no payment                           |
| Corn                   | 1975              | Aug. 31/76                | \$2.11/bu        | \$2.50/bu                | no payment                           |
| Soybeans               | 1975              | Aug. 31/76                | \$4.35/bu        | \$4.94/bu                | no payment                           |
| DESIGNATED COMMODITIES |                   |                           |                  |                          |                                      |
| Sweet Cherries         | 1975              | Dec. 31/75                | 24¢/lb           | 20.5¢/lb                 | 3.5¢/lb                              |
| Summer Pears           | 1975              | Dec. 31/75                | 8.8¢/lb          | 8.3¢/lb                  | .5¢/lb                               |
| Prune Plums            | 1975              | Dec. 31/75                | 9.6¢ /lb         | 6.1¢/lb                  | 3.5¢/lb                              |
| Carrots                | 1975              | Mar. 31/76                | \$50.25/ton      | \$48.00/ton              | \$2.25/ton                           |
| B.C. Raspberries       | 1975              | Dec. 31/75                | 32.8¢/lb         | 24.2¢/lb                 | 8.6¢/lb                              |
| Apples Fresh & process | 1975              | Aug. 31/76                | 8.6¢/lb          | 6.5¢/lb                  | 2.1¢/lb                              |
| Juices & others        | 1975              | Aug. 31/76                | 2.9¢/lb          | 2.0¢/lb                  | 0.9¢/lb                              |
| Early Potatoes         | 1976              | Aug. 31/76                | \$4.50/cwt       |                          | \$1.20cwt/Eastern<br>1.80cwt/Western |

\*(part year — Aug. 12/75 through Dec. 31/75 only)

# PUBLICATIONS

## ECONOMICS BRANCH, AGRICULTURE CANADA

*Available from the Publications Manager, Room 303, Sir John Carling Building, Ottawa, Ontario, K1A 0C5.*

**Federal Agricultural Legislation Up to 1977.** A.R. Jones. Publication No. 77/2. 46 pages.

**Urban Food Consumption Patterns in Canada.** Zuhair A. Hassan and S.R. Johnson. Publication No. 77/1. 58 pages.

**Provincial Agricultural Legislation Up to 1977 — Atlantic Provinces.** A.R. Jones. Publication No. 77/3. Various paging.

**Selected Beef Production Systems in the Atlantic Provinces.** Budgets of various beef production systems. Publication No. 77/4. 40 pages.

**Co-operation in Canada 1975.** J.M. Sullivan. Publication No. 77/5. Bilingual. 23 pages each language.

## MISCELLANEOUS PUBLICATIONS

**British Columbia Agricultural Statistics Factsheet.** Handy five-page leaflet. *Available from B.C. Ministry of Agriculture, Victoria, B.C.*

**Report to Producers on the 1975-76 Crop Year.** Canadian Wheat Board. 22 pages. *Write: The Canadian Wheat Board, 423 Main Street, Winnipeg, Man. R3C 2P5.*

**Canada's Role in World Agricultural Development.** W. David Hopper, President, International Development Research Centre, Ottawa. Publication No. AEEEE/76/14, ISSN 0318-1812. 34 pages. *Available from the School of Agricultural Economics and Extension Education, OAC, University of Guelph, Guelph, Ontario.*

**The Potential of Boxed Beef.** 64 pages. *Available from Agricultural Economics Research Council of Canada, 100 Bronson Avenue, Suite 203, Ottawa, K1R 6G8.*

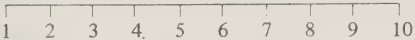
**Farm-Generated Determinants of Land Use Changes in the Rural-Urban Fringe in Canada, 1961-75.** C.R. Bryant, University of Waterloo. 172 pages. *Available from the Lands Directorate, Environment Canada, Ottawa.*



IN REPLY TO AUTHORS AND EDITORS REGARDING APRIL 1977  
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- (4) Stabilization Backgrounder

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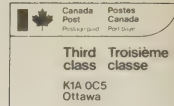


# CONVERSION FACTORS FOR METRIC SYSTEM

| Imperial units         | Approximate<br>conversion factor     | Results in:                          |
|------------------------|--------------------------------------|--------------------------------------|
| <b>LINEAR</b>          |                                      |                                      |
| inch                   | x 25                                 | millimetre (mm)                      |
| foot                   | x 30                                 | centimetre (cm)                      |
| yard                   | x 0.9                                | metre (m)                            |
| mile                   | x 1.6                                | kilometre (km)                       |
| <b>AREA</b>            |                                      |                                      |
| square inch            | x 6.5                                | square centimetre (cm <sup>2</sup> ) |
| square foot            | x 0.09                               | square metre (m <sup>2</sup> )       |
| acre                   | x 0.40                               | hectare (ha)                         |
| <b>VOLUME</b>          |                                      |                                      |
| cubic inch             | x 16                                 | cubic centimetre (cm <sup>3</sup> )  |
| cubic foot             | x 28                                 | cubic decimetre (dm <sup>3</sup> )   |
| cubic yard             | x 0.8                                | cubic metre (m <sup>3</sup> )        |
| fluid ounce            | x 28                                 | millilitre (ml)                      |
| pint                   | x 0.57                               | litre (ℓ)                            |
| quart                  | x 1.1                                | litre (ℓ)                            |
| gallon                 | x 4.5                                | litre (ℓ)                            |
| <b>WEIGHT</b>          |                                      |                                      |
| ounce                  | x 28                                 | gram (g)                             |
| pound                  | x 0.45                               | kilogram (kg)                        |
| short ton (2000 lb)    | x 0.9                                | tonne (t)                            |
| <b>TEMPERATURE</b>     |                                      |                                      |
| degrees Fahrenheit     | (° F-32) x 0.56<br>or (° F-32) x 5/9 | degrees Celsius (° C)                |
| <b>PRESSURE</b>        |                                      |                                      |
| pounds per square inch | x 6.9                                | kilopascal (kPa)                     |
| <b>POWER</b>           |                                      |                                      |
| horsepower             | x 746<br>x 0.75                      | watt (W)<br>kilowatt (kW)            |
| <b>SPEED</b>           |                                      |                                      |
| feet per second        | x 0.30                               | metres per second (m/s)              |
| miles per hour         | x 1.6                                | kilometres per hour (km/h)           |
| <b>AGRICULTURE</b>     |                                      |                                      |
| gallons per acre       | x 11.23                              | litres per hectare (ℓ/ha)            |
| quarts per acre        | x 2.8                                | litres per hectare (ℓ/ha)            |
| pints per acre         | x 1.4                                | litres per hectare (ℓ/ha)            |
| fluid ounces per acre  | x 70                                 | millilitres per hectare (ml/ha)      |
| tons per acre          | x 2.24                               | tonnes per hectare (t/ha)            |
| pounds per acre        | x 1.12                               | kilograms per hectare (kg/ha)        |
| ounces per acre        | x 70                                 | grams per hectare (g/ha)             |
| plants per acre        | x 2.47                               | plants per hectare (plants/ha)       |

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# THE ECONOMICS OF SIZE IN GRAIN FARMING IN SASKATCHEWAN



L.M. Johnson\*

*A survey of 60 grain farms in Saskatchewan showed that before-tax rates of return to equity and management were considerably higher on large farms as compared with medium or small farms. After-tax rates of return on farms with 100-percent equity were about the same for all farm sizes, but the dollar value was considerably higher on the larger farms. The desired equity level and expected capital gains on farmland may be important factors in farmers' decisions on farm expansion.*

## INTRODUCTION

In Western Canada farm size continues to increase and farm numbers continue to decline. A further reduction in farm numbers could result in agriculture's being dominated by some very large farms. This eventually would necessitate changes for transportation and marketing firms, for processors, for suppliers of agricultural inputs, as well as for the rural community and the consumer. The purpose of this paper is to report the results of a study comparing costs and returns on small, medium and large grain farms on the Dark Brown Soils in Saskatchewan to determine which size of farm can produce at the lowest cost or make the best returns. Included is an analysis of the effects of different equity levels and rates of land-value appreciation on after-tax rates of return to equity and management.

## The Study Area and Recent Changes

The study area consisted of census divisions 12 and 13 in west central Saskatchewan.<sup>1</sup> Between 1951 and 1976 farm numbers in these divisions decreased by nearly

35 percent, from 10,398 to 6,863 (Table 1). During the same period, farm numbers in Saskatchewan as a whole decreased by nearly 40 percent, from 112,018 to 69,450.<sup>2</sup> Small farms, 759 acres or less, decreased in number by 60 percent, while large farms, 1,600 acres or more, increased by 160 percent.

In census divisions 12 and 13, small farms, 759 acres or less, represented 69 percent of the total number of farms in 1951 compared with 36 percent in 1976, a drop of nearly one half. Large farms, 1,600 acres or more, increased from four percent of the total number of farms in 1951 to 18 percent in 1976, over a fourfold increase. Similar trends were evident for the province as a whole. Eighty-one percent of all farms were less than 760 acres in 1951 compared with 53 percent in 1976. During this same period, large farms, 1,600 acres or more, increased from three to 11 percent of the total number of farms.

Agricultural census data indicate that between 1961 and 1971 Saskatchewan farms with sales of \$25,000 or more increased from less than one percent of total farms to nearly five percent. Farms with sales between \$10,000

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<sup>1</sup>The area lies roughly between the Alberta border and Saskatoon.

<sup>2</sup>Farm numbers for Saskatchewan were estimated at 69,450 in 1976 using past trends.

**TABLE 1. NUMBER AND PERCENT OF CENSUS FARMS BY SIZE OF FARM IN CENSUS DIVISIONS 12 AND 13 IN SASKATCHEWAN AND THE PROVINCIAL TOTALS, 1951 TO 1976**

| Item                       | 1951    | 1956    | 1961   | 1966   | 1971   | 1976 <sup>a</sup> |
|----------------------------|---------|---------|--------|--------|--------|-------------------|
| — number of farms —        |         |         |        |        |        |                   |
| Census Divisions 12 and 13 |         |         |        |        |        |                   |
| 759 acres or less          | 7,212   | 6,400   | 5,161  | 4,126  | 3,254  | 2,471             |
| 760-1,599 acres            | 2,788   | 3,032   | 3,302  | 3,298  | 3,186  | 3,157             |
| 1,600 acres or more        | 398     | 487     | 680    | 879    | 1,033  | 1,235             |
| Total                      | 10,398  | 9,919   | 9,143  | 8,303  | 7,471  | 6,863             |
| Saskatchewan               |         |         |        |        |        |                   |
| 759 acres or less          | 90,717  | 79,289  | 66,397 | 55,505 | 45,360 | 36,808            |
| 760-1,599 acres            | 18,390  | 20,555  | 22,944 | 24,352 | 24,577 | 25,002            |
| 1,600 acres or more        | 2,931   | 3,547   | 4,583  | 5,829  | 7,033  | 7,640             |
| Total                      | 112,018 | 103,391 | 93,924 | 85,686 | 76,970 | 69,450            |
| — percent of farms —       |         |         |        |        |        |                   |
| Census Divisions 12 and 13 |         |         |        |        |        |                   |
| 759 acres or less          | 69      | 65      | 57     | 50     | 43     | 36                |
| 760-1,599 acres            | 27      | 31      | 36     | 40     | 43     | 46                |
| 1,600 acres or more        | 4       | 5       | 7      | 10     | 14     | 18                |
| Total                      | 100     | 100     | 100    | 100    | 100    | 100               |
| Saskatchewan               |         |         |        |        |        |                   |
| 759 acres or less          | 81      | 77      | 70     | 65     | 59     | 53                |
| 760-1,599 acres            | 16      | 20      | 24     | 28     | 32     | 36                |
| 1,600 acres or more        | 3       | 3       | 5      | 7      | 9      | 11                |
| Total                      | 100     | 100     | 100    | 100    | 100    | 100               |

<sup>a</sup>Estimated for 1976 using trends of previous years.

Source: Census of Canada, Agriculture, Saskatchewan, Statistics Canada, various issues.

and \$24,999 increased from 10 to 25 percent of all farms, while farms with sales of under \$10,000 decreased from 89 percent to 70 percent. Some of these changes resulted from agricultural price increases but also from a greater number of larger farm units.

Larger farms are, therefore, accounting for a correspondingly greater portion of agricultural production and their share is rapidly expanding, so it is important to discover the reason for this growth and to find out whether or not it will continue. Presumably farms will continue to grow if it is profitable.

## OBJECTIVES AND METHOD OF STUDY

The main objective of this study was to determine if large Prairie grain farms are more profitable than medium or small farms. Attempts were made:

- (1) to compare production practices and costs of producing cereal grains and oilseed crops and,
- (2) to show returns to equity and management for

these crops on three sizes of farms on loam and clay-loam soils.

The main source of data was a survey of 60 farms (20 in each size group). Through a structured questionnaire data were obtained on production practices, machinery inventory, crop inputs, average yields and total production in 1975.

Using the survey data, complete farm budgets were prepared to summarize the survey results and put them in perspective. The budget approach was used because the information obtained in the farm survey was mainly on physical inputs to which prices were applied. Information is presented for three farm sizes: 600 acres, 1,200 acres and 2,400 acres of cropland on loam and clay-loam soils. These farm sizes approximate the acreages on the survey farms, which averaged 636 acres, 1,280 acres and 2,287 acres of cropland. The budgets are strictly for cash-grain operations with no livestock. Production practices and cropping systems represent farming patterns found on the Dark Brown Soils in west central Saskatchewan.

**TABLE 2. CAPITAL INVESTMENT AND MAN-MONTHS OF LABOR BY SIZE OF FARM AND TYPE OF SOIL**

| Item                    | Small Farms |           | Medium Farms |           | Large Farms |           |
|-------------------------|-------------|-----------|--------------|-----------|-------------|-----------|
|                         | Loam        | Clay-Loam | Loam         | Clay-Loam | Loam        | Clay-Loam |
| — dollars per farm —    |             |           |              |           |             |           |
| Investment              |             |           |              |           |             |           |
| Land                    | 115,800     | 124,200   | 231,600      | 248,400   | 463,200     | 496,800   |
| Machinery               | 42,240      | 41,310    | 57,445       | 57,685    | 84,455      | 83,880    |
| Buildings               | 6,350       | 6,350     | 9,970        | 9,970     | 14,880      | 14,880    |
| Total                   | 164,390     | 171,860   | 299,015      | 316,055   | 562,525     | 595,560   |
| — man-months per farm — |             |           |              |           |             |           |
| Labor Force             |             |           |              |           |             |           |
| Operator                | 8.20        | 8.05      | 8.70         | 8.50      | 10.88       | 8.46      |
| Family                  | .51         | .49       | 1.11         | 1.10      | 3.70        | 4.41      |
| Hired                   | .07         | .02       | .67          | .84       | 1.97        | 3.62      |
| Total                   | 8.78        | 8.56      | 10.48        | 10.44     | 16.55       | 16.59     |

Source: Unpublished data on land sales, agri-business and survey information.

## PROCEDURES AND FINDINGS

### Capital Investment and Labor Force

Table 2 presents the capital investment and the labor force by farm size and soil type. Land investment is based on the market value of comparable farmland in the study area and on the assessed value of the survey farms. From these data farmland values on loam and clay-loam soils were established at \$193 and \$207 per cultivated acre, respectively. The budgeted machinery and building inventory is based on survey information and is valued at half of the replacement cost in 1975 plus a salvage value for machinery. Salvage value is considered part of the investment because it cannot be recovered until the end of the machine's useful life. As an example, a \$10,000 machine in 1975 with a salvage value of five percent of its initial cost, or \$500, would have an average investment of \$10,000 + \$500 divided by two, or \$5,250. The total investment shown is for fully-owned farms (no land rentals) and is slightly higher for farms on clay-loam soils because of somewhat higher land values.

The labor force is the farmer's estimate of the time spent on the grain enterprise, with some adjustments according to acreages on the budgeted farms. Large farms with four times the acreage of the small farms used only about twice as much labor, around 16.5 man-months compared with about 8.5 man-months. This is a result of the use of larger machines and a somewhat smaller percentage of the land in crops on the large farms.

### Use of Cropland

The land-use pattern is shown by size of farm in Table 3. Summerfallow occupied 37.5, 40 and 45 percent of the cropland on the small, medium and large farms, in that order. Twenty-five percent of the land was stubble-cropped on the small farms compared with 20 percent on the medium farms and only 10 percent on the large farms. Wheat was the major crop and it was grown mostly on summerfallow. There was no noticeable difference in the land-use pattern between loam and clay-loam soils on the survey farms; thus crop acreages are the same for both soil types on the budgeted farms.

**TABLE 3. USE OF CROPLAND BY SIZE OF FARM**

| Type of Crop         | Size of farm |        |       |
|----------------------|--------------|--------|-------|
|                      | Small        | Medium | Large |
| Crop on Fallow       |              |        |       |
| Wheat                | 195          | 330    | 840   |
| Barley               | 30           | 50     | 120   |
| Rapeseed             | —            | 100    | 120   |
| Crop on Stubble      |              |        |       |
| Wheat                | 70           | —      | 40    |
| Oats                 | —            | 80     | 80    |
| Barley               | 80           | 160    | 120   |
| Summerfallow         | 225          | 480    | 1,080 |
| Total Cropland Acres | 600          | 1,200  | 2,400 |

Source: Survey data with adjustments.

**TABLE 4. TOTAL VALUE OF CROP PRODUCTION BY SIZE OF FARM, TYPE OF SOIL AND CROP, 1975**

| Type of Crop    | Small Farms |           | Medium Farms |           | Large Farms |           |
|-----------------|-------------|-----------|--------------|-----------|-------------|-----------|
|                 | Loam        | Clay-Loam | Loam         | Clay-Loam | Loam        | Clay-Loam |
| — dollars —     |             |           |              |           |             |           |
| Crop on Fallow  |             |           |              |           |             |           |
| Wheat           | 23,452      | 20,864    | 38,396       | 36,097    | 96,151      | 94,837    |
| Barley          | 3,841       | 2,912     | 3,762        | 4,678     | 13,083      | 10,496    |
| Rapeseed        | —           | —         | 9,524        | 9,643     | 12,768      | 14,805    |
| Crop on Stubble |             |           |              |           |             |           |
| Wheat           | 2,510       | 3,887     | —            | —         | 3,128       | 2,768     |
| Oats            | —           | —         | 4,659        | 3,765     | 4,615       | 4,615     |
| Barley          | 3,873       | 4,704     | 8,993        | 7,786     | 8,549       | 7,056     |
| Value Per Farm  | 33,676      | 32,367    | 65,334       | 61,969    | 138,294     | 134,577   |

Source: Based on average yields from survey data, land-use pattern in Table 3 and Canadian Wheat Board prices.

### Value of Crop Production

Table 4 presents the resulting value of crop production for the three farm sizes on loam and clay-loam soils. Although some farmers rented part of their land in the survey area, the values shown are for fully-owned farms. Production on the 600-acre (small) farms was about half what it was on the 1,200-acre (medium) farms, where production was slightly less than half what it was on the 2,400-acre (large) farms. The production value on loam soils was from three to five percent higher than on the clay-loam soils in 1975 as a result of slightly higher yields on the former soils. Long-term

yield estimates from survey data indicate crops yield slightly better on clay-loam soils, but the difference is small.

### Costs of Wheat on Fallow

Data in Table 5 show that the combined crop service and machinery cash expenses for wheat on fallow ranged from \$14.11 an acre for medium farms on loam soils to \$16.83 for small farms on loam soils. These cash costs include the crop service inputs, machinery repairs, fuel, oil and lubricants.

**TABLE 5. CROP SERVICES AND MACHINERY EXPENSES FOR WHEAT ON FALLOW AND COST OF PREPARING SUMMERFALLOW BY SIZE OF FARM AND TYPE OF SOIL, 1975**

| Item                                 | Small Farms |           | Medium Farms |           | Large Farms |           |
|--------------------------------------|-------------|-----------|--------------|-----------|-------------|-----------|
|                                      | Loam        | Clay-Loam | Loam         | Clay-Loam | Loam        | Clay-Loam |
| — dollars per crop acre —            |             |           |              |           |             |           |
| Crop Services Expenses               |             |           |              |           |             |           |
| Seed                                 | 5.33        | 5.38      | 6.04         | 5.36      | 5.42        | 5.87      |
| Weed spray                           | 2.26        | 1.06      | .75          | 2.07      | 2.43        | 1.24      |
| Fertilizer                           | 3.57        | 2.51      | 2.28         | 3.13      | 3.09        | 2.83      |
| Crop insurance                       | .70         | 1.45      | 1.03         | 1.28      | .95         | .83       |
| Hail insurance                       | .75         | .42       | .47          | .51       | .54         | .30       |
| Seed cleaning                        | .15         | .17       | .17          | .16       | .16         | .18       |
| Sub-Total                            | 12.76       | 10.99     | 10.74        | 12.51     | 12.59       | 11.25     |
| Machinery Expenses                   |             |           |              |           |             |           |
| Fuel, repairs, oil and lubricants    | 4.07        | 3.72      | 3.37         | 3.41      | 3.18        | 3.02      |
| Crop Services and Machinery Expenses | 16.83       | 14.71     | 14.11        | 15.92     | 15.77       | 14.27     |
| Summerfallow                         | 3.02        | 2.20      | 2.41         | 2.34      | 2.35        | 2.27      |

Source: Survey information and prices from agri-business firms.

**TABLE 6. CROP SERVICES AND MACHINERY EXPENSES FOR WHEAT ON STUBBLE BY SIZE OF FARM AND TYPE OF SOIL, 1975**

| Item                                 | Small Farms |           | Large Farms |           |
|--------------------------------------|-------------|-----------|-------------|-----------|
|                                      | Loam        | Clay-Loam | Loam        | Clay-Loam |
| — dollars per crop acre —            |             |           |             |           |
| Crop Services Expenses               |             |           |             |           |
| Seed                                 | 5.33        | 5.38      | 5.42        | 5.87      |
| Weed spray                           | .69         | 1.03      | 1.14        | 1.21      |
| Fertilizer                           | —           | 2.33      | 2.43        | 1.20      |
| Crop insurance                       | .19         | 1.21      | .55         | 1.20      |
| Hail insurance                       | .38         | .30       | .04         | —         |
| Seed cleaning                        | .15         | .17       | .16         | .18       |
| Sub-Total                            | 6.74        | 10.42     | 9.74        | 9.66      |
| Machinery Expenses                   |             |           |             |           |
| Fuel, repairs, oil and lubricants    | 3.74        | 3.82      | 3.21        | 3.21      |
| Crop Services and Machinery Expenses | 10.48       | 14.24     | 12.95       | 12.87     |

Source: See source, Table 5.

They exclude depreciation, interest on investment and charges for labor, building repairs, overhead and land taxes. Data in Table 5 also indicate that costs of summerfallow ranged from \$2.20 an acre for small farms on clay-loam soils to \$3.02 for small farms on loam soils. Survey data showed fewer tillage operations for summerfallowing on the small clay-loam farms, which reduced the costs of this practice.

### Costs of Wheat on Stubble

Combined crop and machinery cash expenses for wheat

on stubble ranged from \$10.48 to \$14.24 an acre on the small farms (Table 6). They are about \$13 an acre on the large farms. Lower costs on the small loam farms can be attributed to lower inputs for crop services.

### Costs of Oats on Stubble

Information in Table 7 indicates that the cash expenses of producing oats on stubble ranged from \$7.88 an acre on medium clay-loam farms to \$10.29 on the large clay-loam farms. Significantly higher fertilizer use on the larger farms contributed to the higher cost.

**TABLE 7. CROP SERVICES AND MACHINERY EXPENSES FOR OATS ON STUBBLE BY SIZE OF FARM AND TYPE OF SOIL, 1975**

| Item                                 | Medium Farms |           | Large Farms |           |
|--------------------------------------|--------------|-----------|-------------|-----------|
|                                      | Loam         | Clay-Loam | Loam        | Clay-Loam |
| — dollars per crop acre —            |              |           |             |           |
| Crop Services Expenses               |              |           |             |           |
| Seed                                 | 2.95         | 2.98      | 2.59        | 2.68      |
| Weed spray                           | .51          | .62       | .44         | .33       |
| Fertilizer                           | 1.97         | .91       | 1.82        | 3.44      |
| Crop insurance                       | —            | —         | —           | .28       |
| Hail insurance                       | .03          | —         | .07         | .30       |
| Sub-Total                            | 5.46         | 4.51      | 4.92        | 7.03      |
| Machinery Expenses                   |              |           |             |           |
| Fuel, repairs, oil and lubricants    | 3.81         | 3.37      | 3.45        | 3.26      |
| Crop Services and Machinery Expenses | 9.27         | 7.88      | 8.37        | 10.29     |

Source: See source, Table 5.

**TABLE 8. CROP SERVICES AND MACHINERY EXPENSES FOR BARLEY ON FALLOW BY SIZE OF FARM AND TYPE OF SOIL, 1975**

| Item                                 | Small Farms |           | Medium Farms |           | Large Farms |           |
|--------------------------------------|-------------|-----------|--------------|-----------|-------------|-----------|
|                                      | Loam        | Clay-Loam | Loam         | Clay-Loam | Loam        | Clay-Loam |
| — dollars per crop acre —            |             |           |              |           |             |           |
| Crop Services Expenses               |             |           |              |           |             |           |
| Seed                                 | 3.46        | 3.62      | 3.02         | 2.86      | 2.67        | 3.02      |
| Weed spray                           | 3.16        | 2.90      | 1.08         | 1.65      | 1.67        | 1.11      |
| Fertilizer                           | 3.87        | 2.88      | 1.89         | 2.18      | 3.66        | 2.52      |
| Crop insurance                       | .75         | 1.10      | .97          | .24       | 1.33        | .80       |
| Hail insurance                       | .25         | .38       | .68          | .03       | —           | .38       |
| Seed cleaning                        | .08         | .20       | .13          | .18       | .15         | .18       |
| Sub-Total                            | 11.57       | 11.08     | 7.77         | 7.14      | 9.48        | 8.01      |
| Machinery Expenses                   |             |           |              |           |             |           |
| Fuel, repairs, oil and lubricants    | 4.22        | 4.02      | 3.54         | 3.31      | 3.18        | 3.02      |
| Crop Services and Machinery Expenses | 15.79       | 15.10     | 11.31        | 10.45     | 12.66       | 11.03     |

Source: See source, Table 5.

### Costs of Barley on Fallow

Crop and machinery cash expenses for barley on fallow are from three to five dollars an acre higher on small farms than on medium and large farms (Table 8). The difference is due to higher seeding rates, greater use of weed sprays and fertilizers and somewhat larger machinery operating costs on the small farms.

### Costs of Barley on Stubble

Combined cash expenses for barley on stubble ranged from \$10.10 an acre on medium loam farms to \$14.92 an acre on large clay-loam farms (Table 9). The higher costs on the large farms can again be attributed to the greater use of weed sprays and fertilizer inputs.

**TABLE 9. CROP SERVICES AND MACHINERY EXPENSES FOR BARLEY ON STUBBLE BY SIZE OF FARM AND TYPE OF SOIL, 1975**

| Item                                 | Small Farms |           | Medium Farms |           | Large Farms |           |
|--------------------------------------|-------------|-----------|--------------|-----------|-------------|-----------|
|                                      | Loam        | Clay-Loam | Loam         | Clay-Loam | Loam        | Clay-Loam |
| — dollars per crop acre —            |             |           |              |           |             |           |
| Crop Services Expenses               |             |           |              |           |             |           |
| Seed                                 | 3.46        | 3.62      | 3.02         | 2.86      | 2.67        | 3.02      |
| Weed spray                           | .66         | 1.65      | 1.38         | .81       | .77         | 4.35      |
| Fertilizer                           | 3.31        | 1.40      | 1.46         | 4.22      | 2.71        | 3.93      |
| Crop insurance                       | .06         | .92       | .11          | .91       | .08         | —         |
| Hail insurance                       | .50         | .20       | .19          | .21       | .79         | .18       |
| Seed cleaning                        | .08         | .20       | .13          | .18       | .15         | .18       |
| Sub-Total                            | 8.07        | 7.99      | 6.29         | 9.19      | 7.17        | 11.66     |
| Machinery Expenses                   |             |           |              |           |             |           |
| Fuel, repairs, oil and lubricants    | 4.09        | 4.09      | 3.81         | 3.37      | 3.45        | 3.26      |
| Crop Services and Machinery Expenses | 12.16       | 12.08     | 10.10        | 12.56     | 10.62       | 14.92     |

Source: See source, Table 5.

**TABLE 10. CROP SERVICES AND MACHINERY EXPENSES FOR RAPESEED ON FALLOW BY SIZE OF FARM AND TYPE OF SOIL, 1975**

| Item                                 | Medium Farms |           | Large Farms |           |
|--------------------------------------|--------------|-----------|-------------|-----------|
|                                      | Loam         | Clay-Loam | Loam        | Clay-Loam |
| — dollars per crop acre —            |              |           |             |           |
| Crop Services Expenses               |              |           |             |           |
| Seed                                 | 1.82         | 1.83      | 1.77        | 1.90      |
| Weed spray                           | 1.39         | 1.99      | 1.97        | 2.61      |
| Fertilizer                           | 2.64         | 2.50      | 2.54        | 3.20      |
| Crop insurance                       | .81          | 2.09      | .74         | 1.93      |
| Hail insurance                       | 1.19         | .18       | .57         | —         |
| Sub-Total                            | 7.85         | 8.59      | 7.59        | 9.64      |
| Machinery Expenses                   |              |           |             |           |
| Fuel, repairs, oil and lubricants    | 3.42         | 3.46      | 3.19        | 3.31      |
| Crop Services and Machinery Expenses | 11.27        | 12.05     | 10.78       | 12.95     |

Source: See source, Table 5.

### Costs of Rapeseed on Fallow

Data in Table 10 indicate that combined crop and machinery cash expenses for rapeseed on fallow ranged from \$10.78 an acre on large loam farms to \$12.95 an acre on large clay-loam farms. Greater use of weed sprays, fertilizer and higher insurance costs accounted for this difference.

### Depreciation and Interest

Depreciation and interest on investment in machinery are shown in Table 11. Yearly depreciation is the replacement cost of a machine multiplied by .95 and divided by its life expectancy. The depreciation charge per acre is then calculated by dividing the yearly depreciation by the number of cultivated acres on each farm. Capital investment in a machine is the replacement cost plus salvage value divided by two. As indicated earlier, salvage value is included as part of the capital investment in a machine because this value cannot be recovered until the end of the machine's useful life. Investment cost per acre is the total machinery investment multiplied by the interest rate (eight percent) and divided by the number of cultivated acres.

Depreciation charges plus interest on machinery investment ranged from \$7.37 an acre on the large loam farms to \$13.69 an acre on the small loam farms. Although the capital investment in machinery on the large farms is about twice what it is on the small farms (Table 2), the large farms have four times the acreage, which reduces the cost per acre for these items by

nearly one half. Table 11 shows that these fixed cost items are of real significance in lowering expenses on the larger farms.

### Costs of Labor, Buildings, Overhead and Land Taxes

Labor and building requirements shown in Table 12 were based on survey information. Labor, presented previously in Table 2, includes operator, family and hired labor. The average wage rate for male farm help in Western Canada was used to calculate the value of

**TABLE 11. DEPRECIATION AND INTEREST ON INVESTMENT IN MACHINERY BY SIZE OF FARM AND TYPE OF SOIL, 1975**

| Size of Farm and Type of Soil   | Depreciation | Interest on Investment | Total |
|---------------------------------|--------------|------------------------|-------|
| — dollars per cultivated acre — |              |                        |       |
| Small Farms                     |              |                        |       |
| Loam                            | 8.06         | 5.63                   | 13.69 |
| Clay-Loam                       | 7.81         | 5.51                   | 13.32 |
| Medium Farms                    |              |                        |       |
| Loam                            | 5.80         | 3.83                   | 9.63  |
| Clay-Loam                       | 5.77         | 3.84                   | 9.61  |
| Large Farms                     |              |                        |       |
| Loam                            | 4.55         | 2.82                   | 7.37  |
| Clay-Loam                       | 4.79         | 2.99                   | 7.78  |

Source: Based on machinery inventory from survey data and investment in Table 2. Interest determined at 8 percent.

**TABLE 12. ANNUAL LABOR AND BUILDING COSTS, OVERHEAD AND LAND TAXES BY SIZE OF FARM AND TYPE OF SOIL, 1975**

| Size of Farm and<br>Type of Soil | Labor | Building |          | Overhead | Land<br>Taxes |
|----------------------------------|-------|----------|----------|----------|---------------|
|                                  |       | Repairs  | Interest |          |               |
| — dollars per cultivated acre —  |       |          |          |          |               |
| Small Farms                      |       |          |          |          |               |
| Loam                             | 7.22  | .30      | .85      | 1.22     | 1.39          |
| Clay-Loam                        | 7.04  | .30      | .85      | 1.19     | 1.40          |
| Medium Farms                     |       |          |          |          |               |
| Loam                             | 4.31  | .24      | .66      | .84      | 1.47          |
| Clay-Loam                        | 4.29  | .24      | .66      | .85      | 1.48          |
| Large Farms                      |       |          |          |          |               |
| Loam                             | 3.44  | .17      | .50      | .62      | 1.50          |
| Clay-Loam                        | 3.41  | .17      | .50      | .62      | 1.45          |

Source: The outlay for labor is based on the farmer's estimate of time spent on crops in Table 2 and average wages of male farm help in Western Canada as reported by Statistics Canada, Catalogue 21-002, 1975. Building costs and farm overhead are calculated from investment in buildings and machinery in Table 2. Land taxes are calculated from data obtained from the Saskatchewan Department of Municipal Affairs and the Farm Credit Corporation.

all labor. Land taxes were calculated from data supplied by the Saskatchewan Department of Municipal Affairs and the Farm Credit Corporation. The outlay for labor, buildings and overhead on the large farms was about half that on the small farms, again reflecting substantial cost savings as a result of increased farm size. Land taxes varied from \$1.39 an acre on the small farms to \$1.50 an acre on the large farms.

### Total Farm Expenses

Total farm expenses shown in Table 13 were calculated

from the preceding tables. The production costs did not vary much between loam and clay-loam soils for the same size of farm (less than five percent). All costs, excluding interest on investment, averaged about \$16,000 to \$17,000 for small farms, somewhat over \$25,000 for the medium farms and over \$45,000 for the large farms. When interest charges are included, costs per farm increase to more than \$30,000 on the small farms, to about \$50,000 on medium farms and to over \$90,000 on large farms. On a per-cultivated-acre basis, total costs on the small 600-acre farms are about \$50, on the medium 1,200-acre farms about

**TABLE 13. TOTAL FARM COSTS BY SIZE OF FARM AND TYPE OF SOIL, 1975**

| Item                                       | Small Farms |           | Medium Farms |           | Large Farms |           |
|--|-------------|-----------|--------------|-----------|-------------|-----------|
|  | Loam        | Clay-Loam | Loam         | Clay-Loam | Loam        | Clay-Loam |
| — dollars per farm —                       |             |           |              |           |             |           |
| Crop Inputs and Machinery <sup>a</sup>     | 10,979      | 10,465    | 16,824       | 17,668    | 31,980      | 31,941    |
| Buildings, Taxes and Overhead <sup>a</sup> | 1,748       | 1,736     | 3,054        | 3,078     | 5,506       | 5,386     |
| Labor                                      | 4,332       | 4,224     | 5,172        | 5,148     | 8,256       | 8,184     |
| Sub-total                                  | 17,059      | 16,425    | 25,050       | 25,894    | 45,742      | 45,511    |
| Interest Charges <sup>b</sup>              |             |           |              |           |             |           |
| Land                                       | 9,264       | 9,936     | 18,528       | 19,872    | 37,056      | 39,744    |
| Buildings                                  | 508         | 508       | 798          | 798       | 1,190       | 1,190     |
| Machinery                                  | 3,378       | 3,306     | 4,596        | 4,608     | 6,768       | 7,176     |
| Sub-total                                  | 13,150      | 13,750    | 23,922       | 25,278    | 45,014      | 48,110    |
| TOTAL                                      | 30,209      | 30,175    | 48,972       | 51,172    | 90,756      | 93,621    |

<sup>a</sup> Includes cash costs and depreciation on machinery and buildings.

<sup>b</sup> Interest determined at 8 percent.

Source: Calculated from Table 2 and Tables 5 to 12 inclusive.

**TABLE 14. BEFORE-TAX RATES OF RETURN TO EQUITY AND MANAGEMENT AS AFFECTED BY SIZE OF FARM AND TYPE OF SOIL, 1975**

| Size of Farm and Type of Soils | Farm Equity <sup>a</sup> | Value of Production  | Farm Costs <sup>b</sup> | Returns to Equity and Management <sup>c</sup> |       |
|--------------------------------|--------------------------|----------------------|-------------------------|---|-------|
|                                |                          | — dollars per farm — |                         |   | %     |
| Small Farms                    |                          |                      |                         |   |       |
| Loam                           | 164,390                  | 33,676               | 17,059                  | 16,617  | 10.11 |
| Clay-Loam                      | 171,860                  | 32,367               | 16,425                  | 15,942  | 9.28  |
| Medium Farms                   |                          |                      |                         |   |       |
| Loam                           | 299,015                  | 65,334               | 25,050                  | 40,284  | 13.47 |
| Clay-Loam                      | 316,055                  | 61,969               | 25,894                  | 36,075  | 11.41 |
| Large Farms                    |                          |                      |                         |   |       |
| Loam                           | 562,525                  | 138,294              | 45,742                  | 92,552  | 16.45 |
| Clay-Loam                      | 595,560                  | 134,577              | 45,511                  | 89,066  | 14.96 |

<sup>a</sup>Includes investment in land, buildings and machinery.

<sup>b</sup>Includes all cash costs, labor charges and depreciation on buildings and machinery. It excludes interest on equity.

<sup>c</sup>Before-tax.

Source: Previous Tables 2, 4 and 13.

\$41 to \$42 and on the large, 2,400-acre farms about \$38 to \$39. Compared with small farms, this gives a reduction in costs per cultivated acre of about \$8 to \$9 on medium farms and \$11 to \$12 on large farms.

## ANALYSIS

### Before-tax Rates of Return to Equity and Management

Table 14 presents total farm equity, value of production, farm costs and before-tax rates of return to equity and management. In this analysis equity includes the investment in land, buildings and machinery for wholly-owned farms (no land rented or 100-percent equity). Value of production is the total value of crops produced in 1975. The farm costs shown include all cash costs as well as labor charges plus depreciation on buildings and machinery, but excludes interest on equity. These costs represented slightly over 50 percent of the value of production on the small farms, about 40 percent on medium farms and about 33 percent on the large farms. Returns to equity and management increased from a low of 9.3 percent for small farms on clay-loam soils to a high of 16.4 percent for the large farms on loam soils. On a per-cultivated-acre basis returns were about \$26 to \$27 for small farms, \$30 to \$33 for medium farms and \$37 to \$38 for the large farms, indicating considerable increases in returns as farms became larger.

Data on returns to equity and management indicate a slightly lower return for the farms on clay-loam soils compared with loam soils (Table 14). This could be a result of clay-loam soils being somewhat overvalued in relation to loam soils, which would decrease the rate of return. Long-term yield estimates from the survey data indicated that crop yields per acre are one to two bushels higher on clay-loam soils than on loam soils, but yields were lower on the former soils in 1975. Taking this into consideration, probably there is not much difference in returns between these two soil types in this area.

### After-tax Rates of Return to Equity and Management According to Equity Level

An important variable in determining after-tax returns is the level of equity in the farm. This is true because interest on borrowed capital may be deducted as an expense for income tax purposes while interest credit on owned equity may not.

The equity levels varied considerably on the survey farms, so these budgets are shown at four equity levels: 100 percent, 75 percent, 50 percent and 25 percent, assuming all land is owned (no renting). Table 15 presents the investment together with the dollar and percentage returns to equity and management for the four equity levels after income tax deductions. Both federal

**TABLE 15. AFTER-TAX RATES OF RETURN TO EQUITY AND MANAGEMENT AS AFFECTED BY SIZE OF FARM, TYPE OF SOIL AND FOUR EQUITY LEVELS, 1975**

| Size of Farm, Soil,<br>Equity and Returns | Unit | Percent of Equity Owned |         |         |         |
|---|------|-------------------------|---------|---------|---------|
|   |      | 100                     | 75      | 50      | 25      |
| Small Farms — Loam                        |      |                         |         |         |         |
| Equity owned                              | \$   | 164,390                 | 123,292 | 82,195  | 41,098  |
| Return to equity                          | \$   | 11,693                  | 9,734   | 7,632   | 5,437   |
|   | %    | 7.11                    | 7.89    | 9.28    | 13.22   |
| Small Farms — Clay-Loam                   |      |                         |         |         |         |
| Equity owned                              | \$   | 171,860                 | 128,895 | 85,930  | 42,965  |
| Return to equity                          | \$   | 11,335                  | 9,243   | 7,039   | 4,677   |
|   | %    | 6.59                    | 7.31    | 8.19    | 10.88   |
| Medium Farms — Loam                       |      |                         |         |         |         |
| Equity owned                              | \$   | 299,015                 | 224,261 | 149,507 | 74,754  |
| Return to equity                          | \$   | 22,494                  | 19,780  | 17,065  | 14,019  |
|   | %    | 7.52                    | 8.82    | 11.41   | 18.75   |
| Medium Farms — Clay-Loam                  |      |                         |         |         |         |
| Equity owned                              | \$   | 316,055                 | 237,041 | 158,028 | 79,014  |
| Return to equity                          | \$   | 20,600                  | 17,730  | 14,604  | 11,218  |
|   | %    | 6.52                    | 7.48    | 9.24    | 14.20   |
| Large Farms — Loam                        |      |                         |         |         |         |
| Equity owned                              | \$   | 562,525                 | 421,894 | 281,262 | 140,631 |
| Return to equity                          | \$   | 40,316                  | 36,460  | 32,620  | 28,302  |
|   | %    | 7.17                    | 8.64    | 11.60   | 20.13   |
| Large Farms — Clay-Loam                   |      |                         |         |         |         |
| Equity owned                              | \$   | 595,560                 | 446,670 | 297,780 | 148,890 |
| Return to equity                          | \$   | 39,016                  | 34,942  | 30,730  | 25,987  |
|   | %    | 6.55                    | 7.82    | 10.32   | 17.45   |

Source: Calculated from Tables 2, 14 and Farmer's and Fisherman's Income Tax Guide, Revenue Canada, 1975.

and provincial income taxes were calculated and deducted from net income. Provinces have varying income tax rates, but in all cases the larger share goes for federal taxes. The Saskatchewan income tax schedule is used in these budgets, and the only income is from crop sales. Taxes are calculated assuming ownership for all farms. The farm operator is assumed to have four personal exemptions: himself, his wife, one child over 16 years of age and one under 16.

The main variables affecting after-tax returns are equity and farm size. At 75 and 100-percent equity, rates of return are between 6.5 percent and 8.8 percent for all farm sizes. At 50-percent equity, rates of return range from 8.2 to 11.6 percent, while at 25-percent equity the rates range from about 10.9 to 20.1 percent. For all farm-size groups, the percentage returns to equity and management increase significantly as equity declines and income tax becomes a very important item, particularly on the large farms. For instance, on the large

loam farms at the 100-percent equity level, the operator is assessed \$51,834 in income tax on a taxable income of \$95,786. The after-tax rate of return to equity and management amounts to 7.17 percent, lower than the eight percent used in other parts of this paper.

This same farm at the 25-percent equity level is assessed \$30,096 in income tax on a taxable income of \$62,034, while returns to equity and management amount to 20.13 percent. In addition, borrowed capital is paid for at eight-percent interest. This indicates that as the equity level changes from 100 percent to 25 percent, income tax is reduced by \$21,738, from \$51,834 to \$30,096. At the lower equity level, the eight-percent interest charge on borrowed capital of \$421,894 plus the returns to owned equity amounts to \$33,752 plus \$28,302 respectively, a total of \$62,054 compared with a \$40,316 return at the 100-percent equity level. The difference is \$21,738, which equals the reduction in income tax. This is a direct consequence of including interest charges on borrowed capital as an expense.

Small farm operators, short of cash but wishing to expand, might consider borrowing money. This, of course, assumes that these operators have the necessary managerial skills to operate larger farm units. For instance, on a small 600-acre loam farm with 100-percent equity returns are \$11,693 or 7.11 percent (Table 15). By expanding to a medium-sized 1,200-acre farm and retaining 50-percent equity, returns increase by \$5,372, to \$17,065 or to 11.41 percent. Further expansion to a large 2,400-acre farm having 25-percent equity increases returns by another \$11,237, to \$28,302 or to 21.13 percent.

At the 100-percent equity level, after-tax rates of return for all farm sizes remain about the same. For farms of all sizes on loam soils, returns to equity at this level are between 7.0 and 7.5 percent and on clay-loam soils about 6.5 percent, indicating that the progressive method of taxation reduces the rates of return on large farms relatively more than on small and medium farms.

Before-tax rates of return presented in Table 14 indicate larger farms have considerably higher percentage returns than smaller farms, but the above analysis shows this is

not the case if income tax is considered, particularly at higher equity levels. Operators of large farms, however, do have significantly greater dollar returns both before and after income tax deductions.

### After-tax Rates of Return to Equity and Management as Affected by Equity Levels and Land Appreciation

This paper has previously shown how rates of return are affected by size and equity levels, assuming no appreciation in land values. But agricultural land values are not staying constant. In Saskatchewan during the 20-year period, 1954 to 1973, land values increased from \$29 an acre to \$80 an acre. Compounded annually this represents an increase of about five percent a year. Since then, because of favorable grain prices and markets, land has probably doubled in value. Expected future appreciation of land values, grain price levels and demand will all be factors in determining land purchases. Table 16 illustrates the effect of a one-percent and a five-percent annual appreciation in land values on after-tax rates of return to equity and management as related to size and equity levels.

**TABLE 16. AFTER-TAX RATES OF RETURN TO EQUITY AND MANAGEMENT AS AFFECTED BY SIZE OF FARM, TYPE OF SOIL, EQUITY LEVEL AND LAND APPRECIATION, 1975**

| Item and<br>Equity Level  | Small Farms |           | Medium Farms |           | Large Farms |           |
|---|-------------|-----------|--------------|-----------|-------------|-----------|
|   | Loam        | Clay-Loam | Loam         | Clay-Loam | Loam        | Clay-Loam |
| — percent —   |             |           |              |           |             |           |
| Rates of return with no<br>appreciation in land<br>values                       |             |           |              |           |             |           |
| 100%  | 7.11        | 6.59      | 7.52         | 6.52      | 7.17        | 6.55      |
| 75%   | 7.89        | 7.31      | 8.82         | 7.48      | 8.64        | 7.82      |
| 50%   | 9.28        | 8.19      | 11.41        | 9.24      | 11.60       | 10.32     |
| 25%   | 13.22       | 10.88     | 18.75        | 14.20     | 20.13       | 17.45     |
| Rates of return with a<br>one-percent annual<br>appreciation in land<br>values  |             |           |              |           |             |           |
| 100%  | 7.67        | 7.17      | 8.09         | 7.09      | 7.72        | 7.11      |
| 75%   | 8.66        | 7.96      | 9.57         | 8.24      | 9.38        | 8.57      |
| 50%   | 10.45       | 9.38      | 12.54        | 10.43     | 12.70       | 11.49     |
| 25%   | 15.59       | 13.35     | 21.11        | 16.62     | 22.43       | 19.79     |
| Rates of return with a<br>five-percent annual<br>appreciation in land<br>values |             |           |              |           |             |           |
| 100%  | 9.83        | 9.41      | 10.33        | 9.37      | 9.93        | 9.35      |
| 75%   | 11.64       | 11.05     | 12.57        | 11.29     | 12.33       | 11.55     |
| 50%   | 15.06       | 14.12     | 17.04        | 15.12     | 17.12       | 15.96     |
| 25%   | 24.99       | 23.09     | 30.46        | 26.27     | 31.51       | 29.12     |

Source: See sources Table 15.

Throughout this section, as noted previously, all the land is assumed to be owned (no renting). In these computations land appreciation is considered as income for the year. It is realized land-value appreciation is not income that is currently spendable, but it does increase net worth which later can be converted into cash and hence income. One half of the capital gain from land appreciation becomes taxable for the year in which the land is sold. Until then no income tax is paid.

In the following calculations, it is assumed that land increases in value but not machinery or buildings. Thus, with 100-percent equity and five-percent land-value appreciation, the increase in the rate of return to management and total equity, after-tax, is less than five percent due to the machinery and building investment. The after-tax rates of return to operator equity increase quite rapidly as equity levels drop and appreciation rates increase. Under these conditions it pays to have low equity. Current income is lower than with 100-percent equity but, despite the interest payments, after-tax returns appreciate at a faster rate. For instance, at the 100-percent equity level, the after-tax returns for small farms on loam soils amount to 7.11 percent with no appreciation in land value, while at one-percent appreciation returns increase to 7.67 percent and at five-percent appreciation returns increase to 9.83 percent. Comparable returns to equity and management at the 50-percent equity level are 9.28, 10.45 and 15.06 percent. The percentage increase in return is still greater at the 25-percent equity level. This demonstrates the importance of capital gains as a component of farm returns and perhaps is a factor influencing decisions of farmers wishing to expand. The 25-percent equity level noted above, however, is rather low and few farmers are in this position. The survey data showed modal equity levels to be around 70 percent and not varying significantly by farm size. Farmers can purchase land with a down payment of 25 percent on land purchase contracts or other mortgage financing, but they prefer higher average equity levels in the rather risky area that is typical of grain farming.

## SUMMARY AND CONCLUSIONS

A survey of 60 specialized grain farms in Saskatchewan 20 in each of three size groups (small, medium and large) — showed the following important results:

- On fully-owned farms (100-percent equity) the before-tax rates of return to equity and management with no land appreciation ranged from a low of 9.3 percent on small farms on clay-loam soils to a high of 16.4 percent for large farms on loam soils.
- The after-tax rates of return to equity and management with no land appreciation ranged from a low of 6.52 percent for the medium clay-loam farms at the 100-percent equity level to a high of 20.13 percent for the loam farms at the 25-percent equity level.
- By expanding from a small, 600-acre loam farm with 100-percent equity to 1,200 acres with 50-percent equity and 2,400 acres with 25-percent equity, after-tax returns to equity and management with no land appreciation increase from \$11,963 to \$17,065 and \$28,302 respectively, or from 7.11 percent to 11.41 and 20.13 percent.
- By expanding from a 600-acre loam farm with 100-percent equity to 1,200 acres with 50-percent equity and 2,400 acres with 25-percent equity, the after-tax returns to equity and management with a five-percent land appreciation increase from \$16,169 to \$25,483 and \$44,313 respectively, or from 9.83 percent to 17.04 and 31.51 percent.
- The after-tax rates of return to operator equity increase quite rapidly as equity levels drop and land-appreciation rates rise. As an example, at the 100-percent equity level, the returns for small farms on loam soils are 7.11 percent with no land appreciation, while at one-percent appreciation returns increase to 7.67 percent and at five-percent appreciation returns rise to 9.83 percent. Comparable returns at the 50-percent equity level are 9.28, 10.45 and 15.06 percent respectively.
- On fully-owned farms (100-percent equity) with no land appreciation before-tax rates of return to equity and management on loam farms are 10.1, 13.5 and 16.4 percent for the small, medium and large farms. For the same farms at the 100-percent equity level with no land appreciation, the after-tax rate of return

to equity and management is about the same for all farm sizes, 7.0 to 7.5 percent. Again, for the same farms at the 100-percent equity level but with a five-percent appreciation in land values, the after-tax rate of return to equity and management is around 10 percent for all farm sizes. Income tax, therefore, is an important consideration when comparing percentage returns between small and large farms. Operators of large farms, however, do have significantly higher dollar returns both before and after income tax deductions. Farmers in general probably think more in dollar terms than in percentage terms

when considering expansion.

- When all costs are considered on a cultivated-acre basis, the 1,200 and 2,400-acre medium and large farms are producing crops at between \$8 and \$12 an acre less than the 600-acre small farms.
- The per acre costs for depreciation on machinery ranged from \$4.55 on the large farms to \$8.06 on the small farms. This item significantly reduced machinery costs and consequently total costs per acre on the larger farms.

# WORLD PRICE BEHAVIOR OF EDIBLE OILS AND FATS



J. W. Duncker\*

## INTRODUCTION

The oils and fats sector is complex. World edible oil supply is a composite of many oils and fats from a wide variety of sources. More than 20 fats and oils are economically significant. They can be divided into four main groups:

- vegetable oils, or oils from the seeds of annual plants;
- palm oils, or oils from mostly tropical, perennial oil-bearing trees;
- animal fats, mostly tallow and milk fat from cattle and lard from hogs;
- marine oils, or oils from fish and whales.

Many oils and fats are substitutable, some to their full extent and others only partially.

The demand for edible oils and fats is more complex than is often realized. To the demand for household purposes has to be added the demand from consumer-goods industries and to some extent the demand from heavy industries.

Both total supply and total demand of oils and fats are generally thought to have increased rather regularly during the last 15 years. Still, world market prices of

*This article analyzes the world price behavior of edible oils and fats, which has been erratic despite an apparent rather regular increase in both supply and demand in the past 15 years.*

*Important elements in the oils and fats sector are the facts that oils and fats are often by-products of other products, that an increasing share comes from perennial oil-bearing trees, and that growth is, to an important extent, a result of the expanding output and, particularly, exports from developing countries. The final section of the article discusses some of the implications of price variability for the Canadian edible-oil economy.*

edible oils and fats have behaved erratically, more particularly during the last few years.

Canada's oils and fats sector is small relative to the world situation. On the export side rapeseed is the most important oilseed, as Canada's rapeseed production exceeds domestic requirements. The growth of the rapeseed industry is dependent mainly on Canada's ability to export the crop and its products at profitable prices. Rapeseed has a high oil content and hence about 75 percent of the value of the crop lies in the oil. The rest is accounted for by the meal component. Rapeseed profitability is therefore strongly dependent on rapeseed oil pricing. Many fats and oils are rapeseed oil substitutes and international trade is more or less free. Consequently, rapeseed oil prices move in concert with international prices of edible oils and fats. Therefore, the profitability of Canadian rapeseed-growing is strongly dependent on the world price behavior of edible oils and fats.

Canada's other domestic sources of edible oils and fats are soybeans, sunflowerseed and the animal fats. In the case of soybeans, the meal component is more important than the oil component and hence the demand for and the price of soybean meal are key factors in soybean-growing decisions. Canada consumes most of its own soybean production and imports a quantity of soybeans about equivalent to domestic production from the

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United States. Significant quantities of soybean oil and, particularly, soybean meal are also imported from that country.

An explanation of the price behavior of Canadian edible oils requires, among other things, an analysis of world market prices of oils and fats. The purpose of this article is to attempt to isolate and discuss some of the important variables in the oils and fats sector on a world scale. Specifically, it will analyze:

- 1) the world supply of edible oils and fats;
- 2) the world demand for edible oils and fats;
- 3) the interactions of world supply and demand as regards price behavior.

The final section will trace some consequences of world price behavior for the Canadian edible oils and fats sector.

## WORLD SUPPLY OF OILS AND FATS

This section advances the notion that the world supply of fats and oils is largely insensitive to prices. It is suggested that production and exports react to only a minor degree to world price changes, with the price in any given year having little bearing on the supply in the following year.

### Oils and Fats Produced Together with a High-protein Meal

Many of the edible oils are produced in conjunction with a high-protein meal. Sometimes the meal is the more valuable component and is therefore the overriding factor in farmers' decisions regarding production. This is particularly the case with soybean oil. Although it accounts for 20 percent of world production and 25 percent of world exports of edible oils and fats, soybean oil is produced together with a meal that has about twice the value of the oil component. Thus, the demand for and the price of soybean meal are the overriding factors in decisions regarding the growing of soybeans. The United States and Brazil, whose combined production of soybean oil (oil equivalent) is about 85 percent of world production of soybean oil, provide, because of annual decision-making, a large measure of supply flexibility in the short run. However, this supply responds only to a minor extent to world price changes of edible oils and fats (Figure 1). From 1961 to 1968 prices showed a more or less downward trend, but production increased.

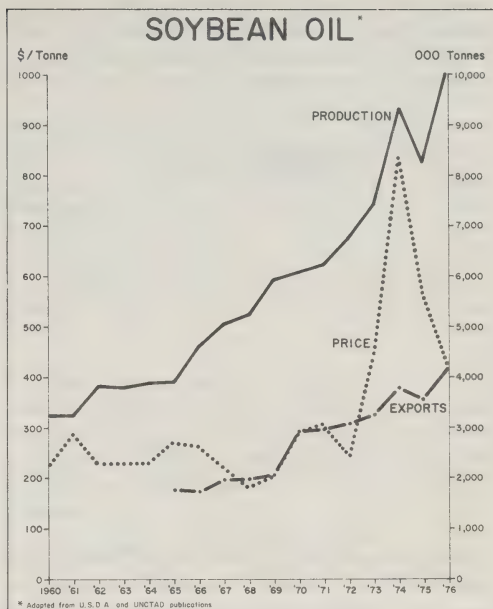


Figure 1

Other annual crops such as rapeseed, sunflowerseed, peanuts and cotton, which together account for about 30 percent of world production and 20 percent of world exports of edible oils and fats, have a sizeable but less important meal component, both in a quantity (Table 1) and in a value sense. However, the production of these crops reacts only to a minor extent to price variations as shown in the case of peanut oil (Figure 2). In the case of cotton, both the oil and meal are by-products of the main (textile) product. Fish oil is produced together with fish meal. The fats and oils pro-

TABLE 1. OIL AND CRUDE PROTEIN CONTENT OF SELECTED OILSEED CROPS

| Crop                | % Oil | % Crude protein |
|---------------------|-------|-----------------|
| Copra               | 64    | 7               |
| Palm Kernel         | 47    | 10              |
| Cottonseed          | 17    | 21              |
| Groundnut (shelled) | 45    | 27              |
| Rapeseed            | 38    | 20              |
| Soybean             | 18    | 36              |
| Sunflower           | 40    | 18              |

Source: F.A.O.

duced from livestock, which account for about 30 percent of world production and 20 percent of world exports of oils and fats, are produced in conjunction with meats and dairy products.

About 45 percent of all tropical oils are produced in West Malaysia and the Philippines. As with many newly-oil-producing, developing countries, domestic requirements are relatively small and most of the production is exported.

A distinction has to be made between palm oil<sup>1</sup> on the one hand, and palm kernel oil and coconut oil, on the other. Palm oil contains an almost equal balance of saturated and unsaturated fatty acids, meaning it can compete more directly with the major edible oils and fats. Palm kernel oil and coconut oil differ in that they contain more saturated fatty acids, especially lauric acid. They are referred to as "lauric" oils. They are not fully interchangeable with the bulk of the world's oils and fats, hence limiting their impact. However, modern technology has reduced the effect of the chemical differences between edible oils and fats, with the result that the prices of the tropical oils are tending to move more in concert with prices of other edible oils.

In summary, the insensitivity to prices makes supply response for fats and oils rather imperfect. Generally,

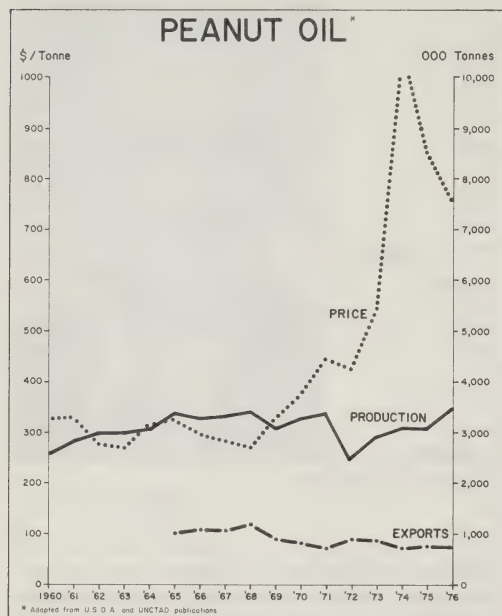


Figure 2

### Edible Oils Derived from a Fixed Production Capacity

A second reason advanced for the price insensitivity of supply is the inflexible or fixed production capacity of the perennial crops, mainly oils from trees — palm, palm kernel and coconut — grown in the Tropics. These oils, which account for about 15 percent of world production and 25 percent of world exports of edible oils and fats, are obtained from trees with a productive life of 25 years or more. Once the trees are planted, investment and capacity are more or less fixed. The production per acre is generally very high and therefore the cost, both fixed and variable per unit of output, tends to be low. The owners will continue producing the oils as long as their variable costs are met. Therefore, the price in any given market has little bearing on production (Figure 3). The output and export flow will continue even if world market prices of edible oils and fats are low. Conversely, production will not respond quickly to price increases because of the length of time required to get trees established and into production.

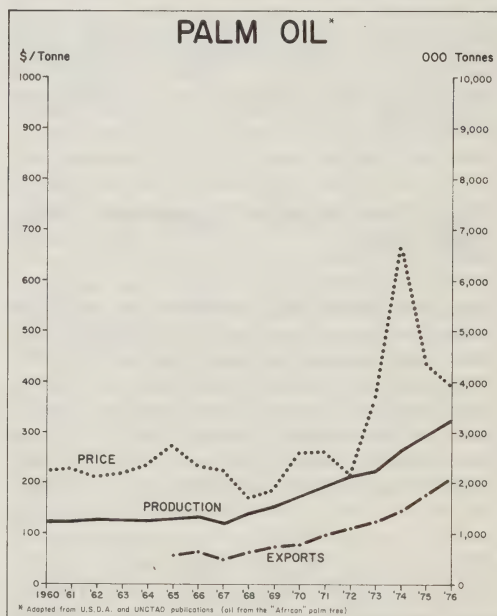


Figure 3

<sup>1</sup>For a detailed discussion of palm oil see "The Increase of Palm Oil in World Markets", J.W. Duncker, Canadian Farm Economics, Vol. 11, No. 2, April 1976, pp. 10-19.

supply has been increasing, regardless of edible oil prices. Fluctuations in supply are partly the result of weather.

### Downward Pressure on Prices

There is a certain built-in tendency to growth in output and exports of total edible oils regardless of price. This is mainly due to the rapid growth of edible-oil production and the export drive of some of the developing countries. Low costs help make exports from the developing countries competitive. Generally, to finance needed imports, these countries are pressed to earn foreign exchange. Oilseeds and oils are some of the important primary products exported to serve this purpose. Palm oil and palm kernel oil, produced exclusively by these countries, have shown a vigorous production increase and even more export growth during the last few years. Palm oil accounts for seven percent of world production of oils and fats and 15 percent of world exports.

A strong production increase of West Malaysian palm oil and perhaps Philippine coconut oil is expected during at least the next 10 years. There is also considerable production potential in other Southeast Asian countries and in central African countries. The availability of land and the further development of high-yielding strains, in addition to the relatively low production costs, virtually assure a production increase.

Peanut oil and cottonseed oil, eight percent and six percent respectively of world production, are also produced mainly in developing countries. Their combined export share is, however, only eight percent and no significant production increase is expected. Nevertheless, production does not decrease if prices decline.

Finally, Brazil is accounting for an increasing share of production and exports of soybean oil. In 1976 Brazilian exports accounted for about eight percent (oil equivalent) of world exports of edible oils and fats compared with virtually nothing in 1971. Brazil is expected to continue to show a strong increase in production and exports. It has potential to increase production significantly and it is striving to develop its economy.

About 35 percent of world production of edible oils and fats (oil equivalent) is in developing countries. They account for between 30 and 35 percent of world exports, and these shares are growing. They account for only about 16 percent of world imports and there is an increasing net export flow from developing countries to the developed world. Their exports, still com-

paratively small, already have had a powerful price impact, as marginal quantities have on an inelastic demand. For example, imports of palm oil into the United States, particularly during the 1975-76 crop year, together with a recession in the U.S. economy, had a strong price-depressing effect despite the fact that they were less than 10 percent of total consumption of oils and fats. Palm oil imports by the United States, which were only 155,000 tonnes in 1973, were 425,000 tonnes in 1975. U.S. domestic disappearance of edible oils and fats was 5.1 million tonnes in 1975. U.S. soybean oil prices declined from more than 40 cents a pound in October 1974 to 15 cents in December 1975.

In contrast, the animal fats (butter, lard and tallow), which account for 30 percent of world production and 20 percent of world exports, are virtually all produced by developed countries in temperate climates. They are not expected to show significant production and export increases.

Consequently, the dynamic factors in world production and in export shipments of edible oils and fats are originating mostly in developing countries. Their continuous production increase, regardless of price or demand, adds an element of downward price pressure to the price insensitivity discussed above. The deflated price index in Figure 4 would tend to confirm this, more particularly for the last eight years. This is another reason why world market prices do not really regulate

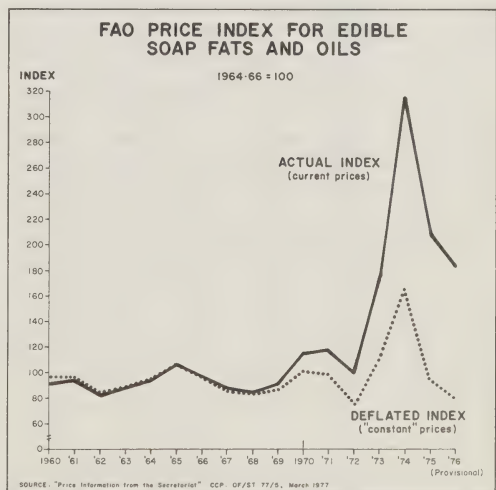


Figure 4

TABLE 2. WORLD PRODUCTION, EXPORTS AND PRICES OF EDIBLE OILS AND FATS, 1960-77

|                         | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 |
|-------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| -- million tonnes --    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Production              |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Total Vegetable Oils    | 12.8 | 13.6 | 14.8 | 14.4 | 15.4 | 16.7 | 17.4 | 18.3 | 19.0 | 19.4 | 20.0 | 21.1 | 22.1 | 22.0 | 25.2 | 23.8 | 25.7 | 24.8 |
| Total Palm Tree Oils    | 3.7  | 4.0  | 3.8  | 3.9  | 4.0  | 4.0  | 4.1  | 3.8  | 4.0  | 4.0  | 4.4  | 4.9  | 5.5  | 5.2  | 5.5  | 6.3  | 6.9  | 7.1  |
| Total Animal Fats       | 10.6 | 10.9 | 11.1 | 11.5 | 11.7 | 12.0 | 11.9 | 12.5 | 12.5 | 12.3 | 12.5 | 13.1 | 13.3 | 13.3 | 14.0 | 13.6 | 13.6 | 13.8 |
| Total Marine Oils       | 1.0  | 1.1  | 1.1  | 1.0  | 1.1  | 1.1  | 1.2  | 1.4  | 1.3  | 1.2  | 1.2  | 1.4  | 1.1  | 1.0  | 1.1  | 1.0  | 1.0  | 1.0  |
| Total                   | 28.1 | 29.6 | 30.8 | 30.8 | 32.2 | 33.8 | 34.6 | 36.0 | 36.9 | 36.9 | 38.1 | 40.5 | 42.2 | 41.5 | 45.8 | 44.8 | 47.2 |      |
| Soybean Oil             | 3.3  | 3.3  | 3.9  | 3.8  | 3.9  | 3.9  | 4.6  | 5.1  | 5.3  | 5.9  | 6.1  | 6.3  | 6.7  | 7.4  | 9.3  | 8.3  | 10.2 |      |
| Peanut Oil              | 2.6  | 2.8  | 2.9  | 3.0  | 3.1  | 3.4  | 3.3  | 3.3  | 3.4  | 3.1  | 3.3  | 3.4  | 2.5  | 2.9  | 3.1  | 3.1  | 3.5  |      |
| Palm Oil                | 1.3  | 1.2  | 1.3  | 1.3  | 1.3  | 1.3  | 1.3  | 1.2  | 1.4  | 1.5  | 1.7  | 1.9  | 2.1  | 2.2  | 2.6  | 2.9  | 3.2  |      |
| -- million tonnes --    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Exports                 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Total Vegetable Oils    |      |      |      |      |      | 4.1  | 4.4  | 4.9  | 5.2  | 5.1  | 5.7  | 5.7  | 6.1  | 6.5  | 6.7  | 6.4  | 7.1  | 7.7  |
| Total Palm Tree Oils    |      |      |      |      |      | 2.2  | 2.4  | 2.0  | 2.2  | 2.2  | 2.2  | 2.2  | 2.6  | 3.0  | 2.8  | 3.6  | 4.1  | 4.3  |
| Total Animal Fats       |      |      |      |      |      | 2.1  | 2.1  | 2.4  | 2.5  | 2.5  | 2.8  | 2.8  | 2.7  | 2.9  | 2.9  | 2.6  | 2.6  | 2.8  |
| Total Marine Oils       |      |      |      |      |      | 0.7  | 0.7  | 0.8  | 0.9  | 0.7  | 0.7  | 0.7  | 0.7  | 0.6  | 0.6  | 0.6  | 0.6  | 0.5  |
| Total                   |      |      |      |      |      | 9.1  | 9.6  | 10.1 | 10.8 | 9.5  | 11.4 | 11.8 | 12.5 | 12.8 | 13.0 | 13.2 | 14.4 | 15.3 |
| Soybean Oil             |      |      |      |      |      | 1.8  | 1.7  | 2.0  | 2.0  | 2.1  | 2.9  | 3.0  | 3.1  | 3.2  | 3.8  | 3.6  | 4.2  | 4.0  |
| Peanut Oil              |      |      |      |      |      | 1.0  | 1.1  | 1.1  | 1.2  | 0.9  | 0.8  | 0.7  | 0.9  | 0.9  | 0.7  | 0.7  | 0.7  | 0.9  |
| Palm Oil                |      |      |      |      |      | 0.6  | 0.6  | 0.5  | 0.6  | 0.7  | 0.8  | 1.0  | 1.1  | 1.2  | 1.4  | 1.7  | 2.1  |      |
| -- dollars per tonne -- |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Prices                  |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Soybean Oil             | 223  | 287  | 226  | 222  | 229  | 270  | 262  | 216  | 178  | 198  | 290  | 305  | 245  | 438  | 833  | 563  | 422  |      |
| Peanut Oil              | 327  | 330  | 275  | 268  | 315  | 325  | 297  | 283  | 270  | 331  | 378  | 446  | 426  | 544  | 1080 | 857  |      |      |
| Palm Oil                | 224  | 228  | 210  | 218  | 234  | 273  | 236  | 223  | 168  | 185  | 260  | 262  | 217  | 376  | 672  | 433  | 391  |      |

Source: Adapted from U.S.D.A. and UNCTAD publications.

world production and world export supplies of edible oils and fats. The data on world production and trade appear to confirm this. Total world production and total world exports of the more liquid (soft) oils have increased regardless of price behavior. Growth was rather steady up to 1972, but prices showed considerable fluctuations. After 1972, prices rose to exceptional levels and then decreased, whereas output and exports were only slightly more irregular than in earlier years (Table 2).

The price behavior of the various oils (except the lauric oils) has been remarkably similar, but the theory of price insensitivity can be supported by analyzing the price-output relationships of the individual oils. The output and exports of soybean oil, for example, seem to react little to its pricing. The output and exports of palm oil have shown virtually uninterrupted growth since 1967, despite strong price fluctuations. Also, the output and exports of peanut oil have reacted little to varying prices.

In summary, it seems clear that the output and exports of edible oils react to price variations to only a slight extent. This in turn tends to aggravate price variations.

## **WORLD DEMAND OF EDIBLE OILS AND FATS**

World demand is largely concentrated in developed industrial areas with larger urban centres, relatively high standards of living and relatively cool climates, i.e., mainly North America, Europe and Japan. These areas are the principal consumers of world oil production. They account for about 65 percent of world production of edible oils and fats. Another net seven percent of world production is imported from developing countries. Thus, more than 70 percent of world production of edible oils and fats is consumed by about 20 percent of the world population.

The demand for oils and fats in the developed world can be differentiated into a demand for household uses and a demand for various 'industrial' purposes. At least in Western World households (in North America and Western Europe) most direct use of edible oils and fats is through margarine and butter consumption in a retail market. The remaining edible oils and fats are inputs in the manufacturing of food products such as confectionery, bakery products, household ingredients and convenience foods. They are also used in restaurants, fast-food outlets, etc. This 'industrial' demand uses edible oils and fats mainly as shortening, cooking and salad oils.

The demand for edible oils for household purposes is probably not very responsive to price changes in a given set of economic circumstances. Hard evidence cannot be offered but it is reasonable to assume that this demand is also not very responsive to changes in consumer disposable income resulting from changes in the economic climate or the business cycle. The edible-oil products in the retail market are relatively cheap and meet a basic consumer need. Therefore, the demand for these products for household use is probably steady and inelastic. On the other hand, edible-oil products destined for 'industrial' uses meet a more sensitive demand. This demand is one of a more luxurious nature and is likely to be more susceptible to changes in the business cycle. In times of economic adversity there is, among other things, a tendency to cease dining out and to curtail the purchase of expensive, processed convenience foods in favor of home cooking. Apparently, increased use of edible oils in home cooking does not compensate for curtailed 'industrial' demand. In the less affluent countries oil prices play more of a role and the use of edible oils and fats for home cooking also may decrease in times of depression.

Generally, in the short run or under constant economic conditions, oils and fats are likely to be consumed at their usual rate regardless of price changes, unless prices become very high or very low. With all other factors constant, price changes of edible oils and fats are probably too insignificant in total expenditure to change consumption greatly. However, a change in the general economic climate has affected demand for edible oils and fats in the United States (Figure 5). A decrease in the U.S. domestic disappearance resulted during the economic recession of the 1974-75 crop year after high consumption in 1973-74. It is also interesting that at the end of the 1973-74 crop year domestic disappearance was high despite the fact that edible-oil prices were at record levels and that subsequently, through the first nine months of 1974-75, both domestic disappearance and prices dropped. This indicates a strong decrease in demand, or in economic terms, a significant backward shift of the demand curve for edible oils and fats.

In this respect, Table 3 illustrates both the relative importance and cyclical nature of margarine and butter on the one hand and shortening, salad and cooking oils on the other hand.

In the developed world, the rather cyclical demand (mainly shortening, salad and cooking oil) for 'industrial' purposes tends to be more important than the more steady retail or household demand (mainly margarine

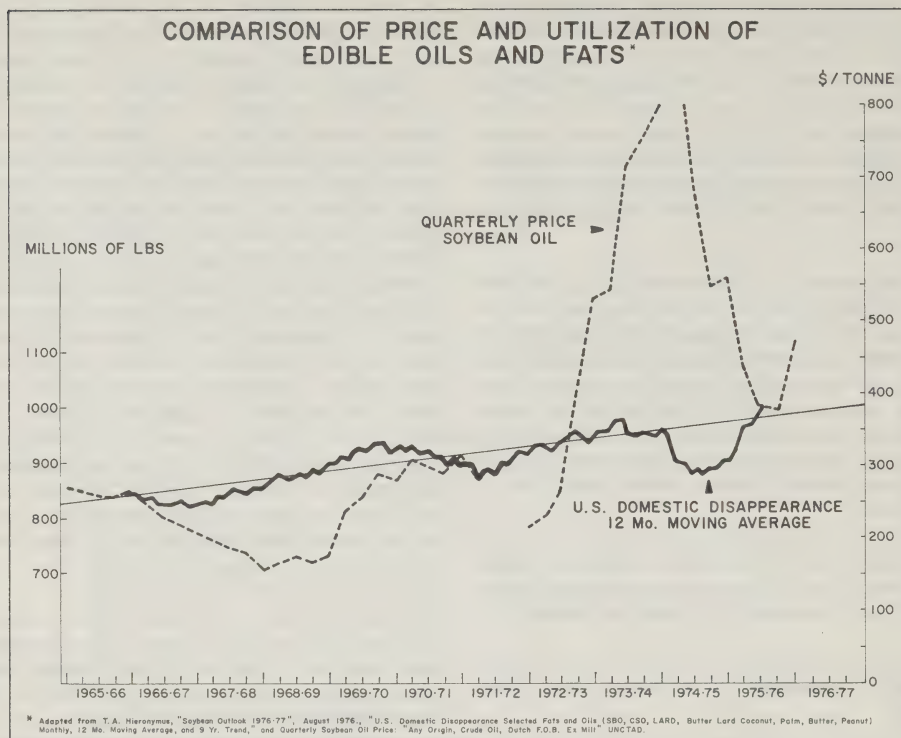


Figure 5

and butter). The increase in demand for edible oils and fats from year to year is therefore less regular than is often assumed.

## DEMAND — SUPPLY INTERACTION AND PRICES

So far this paper has indicated that the supply of edible oils and fats is not greatly influenced by prices, either in the short or long run. It has also indicated that demand for edible oils and fats is rather insensitive to price changes under constant economic conditions. Prices, however, are quite sensitive to changes in supply and demand.

The world supply of edible oils and fats has been erratic since about 1970. There has been an increasing share of production derived from annual crops in which the meal component dominates planting decisions from year to year and for which also weather directly influences

production. Furthermore, there has been the tendency for developing countries to strongly increase production and exports of edible oils. Therefore, world production and, to a lesser extent, exports of edible oils and fats have increased (though irregularly) since 1970.

It appears that world demand increases more regularly than world supply, except in times of severe economic recession, but recently at a slower pace than supply.

Prices of various edible oils showed increased variability during the 1970s. From 1972 onwards severe shortages of some edible oils developed against a steady increase in world consumption. Stocks were depleted to near-crisis levels and competition forced prices higher for all oils; in fact prices rose to record levels during 1973-74. World production increased only slightly in 1974-75 as the 1974 U.S. soybean crop was affected by drought. However, during the same crop year world demand was

TABLE 3. U.S. DOMESTIC DISAPPEARANCE OF EDIBLE OILS AND FATS BY END PRODUCTS

| Crop Year | Margarine and Butter |                | Shortenings, Salad and Cooking Oils |                |
|-----------|----------------------|----------------|-------------------------------------|----------------|
|           | Quantity             | Annual Changes | Quantity                            | Annual Changes |
|           | — mil. pounds —      | — percent —    | — mil. pounds —                     | — percent —    |
| 1972 - 73 | 3,373                |                | 7,292                               |                |
| 1973 - 74 | 3,369                | - 0.1          | 7,586                               | + 4.0          |
| 1974 - 75 | 3,396                | + 0.8          | 7,345                               | - 3.2          |
| 1975 - 76 | 3,499                | + 3.0          | 8,134                               | + 10.7         |

Source: "Fats and Oils Situation" U.S.D.A.

increasingly affected by the deepest recession since World War II. Despite limited supplies, oil prices declined again. Supplies for 1975-76 were again very large, further depressing prices. During the recovery demand returned to higher levels, and after a certain lag, prices followed.

Currency fluctuations, the fuel crisis and strong speculation have, among other things, added to the price instability. Strong inflationary factors have raised price levels. However, during the last few years output and, to an even greater degree, exports of developing countries have increased, with a price-depressing effect.

Figure 6 depicts (theoretically) the characteristics and the interrelationships of supply and demand. It explains to a large extent the price variability of edible oils and fats in world markets. Both consumption and production react little to price changes in the short run. Supply within a crop year varies only to a limited extent regardless of price. Demand or utilization in the short run and under more or less constant economic conditions is also rather steady regardless of price. This is indicated by the vertical position of both the demand curve (D) and the supply curve (S) in any of the subsequent (crop) years 1, 2, 3, 4. A large change in price (P) corresponds with only small quantity (Q) changes.

However, from year to year production changes, even if prices remain the same, as discussed above. Also, utilization changes from year to year because of population growth and changing per capita consumption associated with changing economic conditions. This is depicted by the shifts of both the supply and the demand curves from year 1 through year 4. The demand (D) and supply (S) curves move irregularly to the right from year to year as both supply and demand increase irregularly.

Figure 6 shows that the inelasticity of quantities to price (the vertical position of the supply and demand curves) together with the irregular increase of production and utilization (the irregular changes to the right) are responsible for a high degree of price instability.

The price (P) changes erratically from year 1 through year 4. In addition the supply curve (S) moves faster to the right than the demand curve (D) — that is, production increases faster than consumption. This accounts for the generally decreasing prices discussed in this paper.

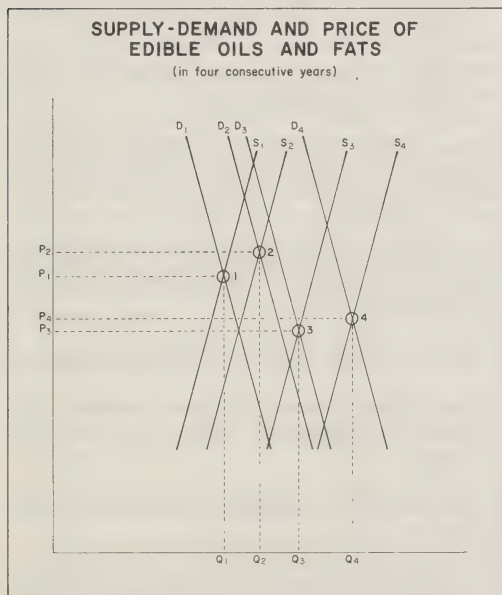


Figure 6

## SOME IMPLICATIONS FOR THE CANADIAN EDIBLE OIL ECONOMY

### The Processing Industry

Budgeting costs and returns in the Canadian oilseed-crushing industry is made complex by the price volatility of edible oils and fats. The main determining cost factor for rapeseed and soybean crushers is the price of oilseeds. Gross income of the crushers depends on crude-oil and high-protein-meal pricing. The erratic price behavior of oils and fats constitutes a very real price or profit risk, particularly if substantial time separates the buying of the oilseeds from the selling of the oilseed products. Soybean oil is a close substitute for rapeseed oil and therefore their price developments are rather parallel. Canadian edible-oil refineries buy crude rapeseed oil exclusively and crude soybean oil mainly from Canadian crushers (with whom they are sometimes affiliated). Understandably, the price for crude soybean oil in Canada is related to the U.S. price. The Canadian price is higher roughly by a 10-percent import duty and transportation costs from the United States.

In 1976, 29 percent of Canadian production of deodorized oils was from rapeseed oil and 34 percent was from soybean oil. Other oils used in this production are mostly off-shore oils and are imported through brokers. They are again mostly tropical oils (palm oil 11 percent, palm kernel oil two percent, and coconut oil five percent). There is frequently a lag of several months between ordering and receiving those imported crude oils. There is therefore an increased price risk for processors with these oils compared with the domestically-produced oils. The Canadian crushers and refiners generally hedge their transactions in the soybean oil futures market in Chicago and thereby guarantee some price protection. In addition to the risk involved in lengthy delivery time and divergent price developments, there is the difficulty of matching delivery and price cover with production. Discrepancies mean uncovered stocks or positions. As about three quarters of the cost price of refined oils consist of crude oil, there is a very real profit risk that is directly related to price variability. Prices vary from moment to moment and from manufacturer to manufacturer. The industrial buyers of refined edible oils are very price-conscious and the input mix of refined oils depends virtually on price, besides availability. The timing of edible-oil transactions is a matter of serious concern for refiners and manufacturers. Each oil-buying transaction implies potentially different margins, which is partly due to the price variability of edible oils and fats in world markets.

### Oilseed Production

Prices for Canadian oilseeds reflect prices for oilseeds, oils and meals in world markets. Because the price of rapeseed is particularly sensitive to the vagaries of the world edible-oil market, it is likely to continue to be relatively volatile. It is likely perhaps to be somewhat depressed in the long run if the projected ample supplies of edible oils materialize. The high-protein-meal market is not expected to have such ample supplies. Prices for soybeans are therefore likely to be stronger than those of rapeseed.

### REFERENCES

1. UNCTAD Commodity Prices, various bulletins.
2. U.S. Department of Agriculture, "Foreign Agricultural Circular" FOP 4-76, 12-76, 22-76, various issues.
3. F.A.O.: "Standard Conversion Factors".
4. F.A.O.: OF/ST 77/5 March 1977 "Price Information from the Secretariat".
5. T.A. Hieronymus, Soybean Outlook 1976-77. U.S. Mid-West Outlook Conference, August 1976.
6. "Fats and Oils Situation", Economic Research Service. U.S. Department of Agriculture, various issues.
7. George L. Kromer, "Palm Oil in the World Fats and Oils Economy", September 1974.
8. J.W. Duncker, "The Increase of Palm Oil in World Markets", Canadian Farm Economics, Volume 11, No. 2, April 1976.
9. L.R. Rigaux, A Preliminary Paper on the Canadian Edible Oils Industry. Commissioned by the Food Prices Review Board.
10. Mr. A.E. Cheadle, Canada Packers Ltd., Toronto.
11. Tariff Board Reference No. 154, Vegetable Oil Products, Proceedings and Exhibits, June 3-4, 1975, Ottawa.
12. Members of the Institute of Edible Oil Foods 1976-77.
13. "The Canadian Vegetable Oil Industry", N.H. Grace and H.W. Lencon. Agricultural Institute Review, September and November 1949.

# PRAIRIE BEEF PRODUCERS' MARKETING PRACTICES AND OPINIONS



J.C. Lowe\*

*A mail-questionnaire survey of Prairie cattle producers showed that producers rate "pricing and selling procedures", "market information", and "grades and grading" as their primary cattle marketing problems. While producers are not unanimous, increased producer involvement rates as the most important means of improving the marketing system.*

## INTRODUCTION

The performance of the beef marketing system on the Prairies is important to producers, processors, distributors and consumers. One way to improve the performance of the system is, through research, to find out more about market participants — their marketing practices, their problems as they see them, and their opinions on how cattle marketing can be improved<sup>1</sup>. Toward that end, the Economics Branch of Agriculture Canada at Regina in 1975 undertook a mail-questionnaire survey of cattle producers to determine their marketing practices and their perceptions of market performance. This article summarizes some of the important results of that study<sup>2</sup>. The information may assist policy-makers and participants in the cattle industry in efforts to develop, promote and implement improvements in the beef marketing system.

## METHODOLOGY

The questionnaire used in the study had 19 open-ended multiple-choice questions on subjects that included the

producer's enterprise, marketing outlets, practices and problems as well as ways to improve cattle marketing. Limitations of this survey method are well known [1]. The findings of such a beef questionnaire are extremely general and with respect to marketing problems can only identify areas of interest for further research.

The mail survey covered approximately 8,400 cattle farms selected at random in 25 prairie census divisions. These divisions were randomly chosen by an area-sampling technique from all divisions stratified by predominant enterprise type and estimated average proximity to market of producers in each division. A response rate of about 14 percent yielded a sample of 1,215 usable questionnaires. Comparisons of sample characteristics with sparse population information indicate a fairly representative sample was obtained with respect to enterprise size and type, age of operator and province of origin.

## CHARACTERISTICS OF ENTERPRISES AND OPERATORS

Cow-calf and cow-calf-finishing types made up respectively 48 and 38 percent of the 1,215 enterprises in the sample. Other types of enterprises and their percentages were: breeding stock, six percent; finishing, three percent; stocker, two percent, and other, three percent.

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<sup>1</sup> This is not to suggest that beef marketing research should be confined to the producer level alone; obviously attention should be given to all levels in the system.

<sup>2</sup> A more detailed unpublished report is available from the author.

The number and sizes of enterprises, based on the number of head of cattle sold annually, were as follows: 108 enterprises selling 125 head and over, 82 selling 86-124 head, 133 selling 55-85 head, 385 selling 23-54 head, and 374 selling 1-22 head. Information on annual cattle sales was not supplied by 133 enterprises.

Slaughter steers and heifers were the most predominant class of cattle sold, averaging 66 head for the 472 enterprises marketing them. Feeders, 575 pounds and over, second most predominant, averaged 47 head for the 421 enterprises selling them and were followed by stockers and feeders under 575 pounds that averaged 35 head for 479 farms.

Approximately 97 percent of the operators were owner-managers. Nearly 75 percent of the enterprises were located on farms with only one operator. Family corporations, partnerships and non-farm corporations accounted, respectively, for 13, 11 and one percent of the enterprises.

Almost 70 percent of the operators were 40 years old or more and about 40 percent were 50 years old or over. Only eight percent of the operators were under 30 years of age.

## MARKETING PRACTICES

### Market Choice

Seventy-five percent of the producers most often sold their cattle through public stockyards (terminal markets) and auction markets, accounting for 46 and 29 percent, respectively. Direct sales to packing plants was the most frequently used market outlet of 14 percent of the producers. Order buyers, dealers or drovers, and special or seasonal sales were each favored by three percent of the sellers. Two percent of the respondents preferred other producers or feedlots.

Smaller producers tended to use public stockyards to a greater extent than larger producers. About 50 percent of those marketing fewer than 50 head annually used the terminal yards most often, compared with only 25.4 percent of those marketing over 200 head annually. A similar pattern existed for producers marketing through auction markets. Thirty percent of the large-size group marketed directly to packing plants.

Nearly half of the feedlot operators marketed directly to plants, with about 30 percent selling through the terminal markets. Cow-calf and stocker enterprises were the main users of the terminal markets. About 50

percent of these producers marketed through the public yards while another 30 percent used auction markets most often.

Nearly one quarter of the Alberta producers marketed cattle directly to plants, a considerably higher proportion of producers than in the other two provinces.

Table 1 indicates that 44.5 percent of the producers considered price to be the most important reason for choosing the market they use most often and that 66.5 percent said price was one of the three most important reasons for choosing their market outlets.

**TABLE 1. REASONS FOR CHOICE OF MARKET OUTLET RATED FOR IMPORTANCE<sup>a</sup>**

| Reason                    | First | Second | Third |
|---------------------------|-------|--------|-------|
| — percent of producers —  |       |        |       |
| Price                     | 44.5  | 15.7   | 6.3   |
| Location                  | 26.4  | 16.9   | 9.6   |
| Fair Treatment            | 15.6  | 13.7   | 16.6  |
| Services                  | 11.4  | 14.4   | 13.7  |
| Cost                      | 6.3   | 8.1    | 6.3   |
| Other Convenience Factors | 2.7   | 6.5    | 9.0   |
| Tradition                 | 1.9   | 2.8    | 5.5   |
| Other                     | 3.5   | 1.2    | 2.7   |

<sup>a</sup>Percentages do not add to 100 because some producers did not reply to the question and some gave two or more reasons as equally important.

Location was ranked as most important by the second largest group of producers, 26.4 percent, followed by fair treatment, 15.6 percent, and services, 11.4 percent. The high ranking of "location" may only reflect that many producers have little choice in where they market their cattle. Only 20.7 percent of the producers placed cost among their three top reasons for choosing a market. Even though cost is partly reflected in location, this may indicate that many producers have little choice in selection of markets, that cost is fairly uniform among these market outlets, or that there is a lack of awareness of marketing costs.

### Price Determination

Most cattle were sold through auction markets or public stockyards where price determination is primarily by auction. Table 2 shows that 958 producers disposed of their cattle this way. The next largest group, 120, established price by private treaty. Producers who sold directly to packers may have used private treaty, some type of formula pricing or a sealed-bid auction.

**TABLE 2. PRICING PRACTICES COMMONLY USED BY PRODUCERS**

| Pricing Practice | Producers |         |
|------------------|-----------|---------|
|                  | Count     | Percent |
| Auction          | 958       | 78.8    |
| Private Treaty   | 120       | 9.9     |
| Formula Pricing  | 25        | 2.1     |
| Other            | 18        | 1.5     |
| No Response      | 94        | 7.7     |
| Total            | 1,215     | 100.0   |

The largest group of producers, 898 or 73.9 percent, sold on a live-weight basis. Among this group, 397 or 32.7 percent, indicated use of estimated grades as a basis for settlement. (Table 3)<sup>3</sup>.

**TABLE 3. BASIS FOR SALE COMMONLY USED BY PRODUCERS**

| Basis for Sale                  | Producers |         |
|---------------------------------|-----------|---------|
|                                 | Count     | Percent |
| Live Weight                     | 501       | 41.2    |
| Live Weight and Estimated Grade | 397       | 32.7    |
| Live per Head                   | 164       | 13.5    |
| Live per Lot                    | 33        | 2.7     |
| Carcass Grade and Weight        | 47        | 3.9     |
| Carcass Weight                  | 7         | 0.6     |
| No response                     | 66        | 5.4     |
| Total                           | 1,215     | 100.0   |

### Distances to Market

A comparison of the distances to their usual markets and to their nearest markets (Table 4) reveals that proximity is not a major consideration for producers when choosing market outlets. Although 50 percent of the producers were over 50 miles from markets where they usually sold, only 28 percent of them were over 50 miles from their nearest outlet.

### Sources of Information

Table 5 indicates that radio was the primary source of livestock market information for 66 percent of the producers. Over 16 percent ranked television as most important. Though auction markets were the chief

source of market news for only 11 percent of the producers, nearly half of all producers rated auction markets as one of the three most important sources of livestock market information.

The survey showed that about 60 percent of producers listened to or read market reports daily, 20 percent used them weekly, and 12 percent referred to them only when they sold cattle.

**TABLE 4. PRODUCERS' MILEAGE TO USUAL MARKET AND TO NEAREST MARKET**

| Mileage | Usual Market |         | Nearest Market |         |
|---------|--------------|---------|----------------|---------|
|         | Count        | Percent | Count          | Percent |
| 0 - 10  | 90           | 8.0     | 150            | 13.5    |
| 11 - 20 | 123          | 11.0    | 202            | 18.2    |
| 21 - 50 | 348          | 31.0    | 451            | 40.5    |
| Over 50 | 558          | 50.0    | 310            | 27.8    |
| Total   | 1,119        | 100.0   | 1,113          | 100.0   |

### MARKETING OPINIONS

#### Problems

Fourteen marketing problems were listed in the questionnaire and producers were given an opportunity to list others. They listed only three problems as most important with any significant degree of frequency: pricing and selling procedures, 30.9 percent of producers; grades and grading, 19.6 percent and market information, 15.8 percent (Table 6). Other problems rated as most important included weighing practices and conditions, 6.8 percent of producers; shrinkage, 5.5 percent and long distance transportation, 7.2 percent.

**TABLE 5. SOURCES OF MARKET INFORMATION RATED FOR IMPORTANCE<sup>a</sup>**

| Source                   | First | Second | Third |
|--------------------------|-------|--------|-------|
| — percent of producers — |       |        |       |
| Radio                    | 66.5  | 13.0   | 5.2   |
| Television               | 16.6  | 13.6   | 4.9   |
| Auction Markets          | 11.4  | 17.6   | 18.9  |
| Weekly Newspapers        | 6.0   | 20.6   | 16.2  |
| Other <sup>b</sup>       | 10.4  | 20.9   | 30.4  |

<sup>a</sup>Percentages do not add to 100 because some producers considered more than one source to be most important.

<sup>b</sup>Other sources include daily newspapers, Canfax, commission firms and truckers.

<sup>3</sup>While buyers estimate the carcass grade of the live animal when bidding, there is some question about the respondents' interpretation of the use of "grade" as a basis for live sales.

**TABLE 6. MARKETING PROBLEMS RATED FOR IMPORTANCE**

| Problem                  | First | Second | Third |
|--------------------------|-------|--------|-------|
| — percent of producers — |       |        |       |
| Pricing and Selling      |       |        |       |
| Procedures               | 30.9  | 16.2   | 9.3   |
| Grades and Grading       | 19.6  | 17.2   | 8.4   |
| Market Information       | 15.8  | 8.9    | 10.6  |
| Weighing Practices and   |       |        |       |
| Conditions               | 6.8   | 7.2    | 6.3   |
| Long Distance            |       |        |       |
| Transportation           | 7.2   | 4.7    | 7.2   |
| Shrinkage                | 5.5   | 5.9    | 6.3   |
| Marketing Deductions     | 2.0   | 3.7    | 6.2   |
| Rail Grading             | 2.8   | 3.5    | 1.7   |
| Cattle Bruising and      |       |        |       |
| Injury                   | 1.5   | 2.1    | 3.5   |
| Local Transportation     | 2.1   | 1.5    | 1.9   |
| Brand Inspection         | 2.2   | 1.2    | 2.1   |
| Buyer Bonding            | 1.2   | 0.9    | 1.5   |
| Feeding Contracts        | 0.6   | 1.2    | 0.7   |
| Insurance                | 0.9   | 0.7    | 0.6   |
| Other                    | 5.5   | 2.6    | 1.7   |

Note: Percentages may not sum to 100.0 because of non-response to the question or because some items were rated equally.

Problems related to pricing and selling procedures were ranked among the three most important problems by 56.4 percent of producers. Similarly, grades and grading was top-rated by 45.2 percent of producers and market information by 35.3 percent.

Cross-tabular analysis did not reveal relationships between producers' perceptions of marketing problems and province of origin, age of operator or enterprise type. However, marketing problems were viewed differently by different enterprise size groups. Producers selling 200 head and over annually rated pricing and selling procedures as their most important problem, significantly less frequently than did smaller enterprises. Market information was chosen most frequently as the most critical problem by this large size group, significantly more often than smaller enterprise groups; in fact, the percentage of producers rating market information as the most important problem increased in direct relation to the size of enterprise. In contrast, the percentage of producers rating grades and grading as most important was inversely related to size.

## Problems by Market Outlet

Producers who generally sell via more sophisticated marketing methods or who generally have better bargaining positions<sup>4</sup> tended to place less emphasis on problems associated with pricing and selling procedures than other groups. Breeding stock producers and feedlot operators using special sales and specific forms of direct selling would be included in this group. Table 7 shows that producers selling at special or seasonal sales, directly to packers or to order buyers rated this problem less frequently than those using other outlets.

Producers whose primary marketing channel is direct selling to other producers rated problems associated with grades and grading, and pricing and selling procedures as most important with a significantly higher frequency than did those marketing via other outlets — 42 percent compared with 20 percent of those marketing via public stockyards.

Those who sell primarily to order buyers rated shrinkage problems as more important than did other groups. Similarly, long distance transportation received relatively more attention from those using special and seasonal sales.

It is difficult to determine cause and effect in these relationships, i.e., a producer may choose a particular market outlet because of problems he perceives in other channels or he may recognize problems only in the method he uses.

## Problem Sources

The problem sources identified by producers are linked with some degree of consistency to the problems rated as most important in that the sources are those directly associated with the designated problem areas. In association with their principal problems (pricing and selling procedures, grades and grading, and market information), producers named government, the packing industry and the wholesale and retail trade as the three most important underlying sources of these concerns.

Table 8 reveals that 20.5 percent of producers rated government as their greatest problem source and that 34.1 percent of them said government was one of the three most important problem sources. Comments on

<sup>4</sup> Bargaining position has been viewed as the degree of flexibility a seller has with respect to selling intentions [2], i.e., the option to reject bids without incurring significant marketing costs.

**TABLE 7. MARKETING PROBLEMS RATED "MOST IMPORTANT" BY PRODUCERS AND CLASSIFIED BY PRIMARY MARKET OUTLET USED<sup>a</sup>**

|  | Public<br>Stockyard | Country<br>Auction<br>Market | Special or<br>Seasonal<br>Sale | Dealer<br>or<br>Drover | Order<br>Buyer | Packer<br>Buyer | Other<br>Producers |
|--|---------------------|------------------------------|--------------------------------|------------------------|----------------|-----------------|--------------------|
| — percent of producers —   |                     |                              |                                |                        |                |                 |                    |
| Pricing and Selling Procedures   | 30.4                | 27.8                         | 18.6                           | 25.7                   | 23.6           | 23.3            | 30.8               |
| Grades and Grading   | 20.4                | 18.1                         | 11.9                           | 14.3                   | 16.4           | 18.8            | 42.3               |
| Market Information   | 15.4                | 13.6                         | 11.9                           | 11.4                   | 16.4           | 16.4            | 0.0                |
| Long Distance Transportation   | 6.4                 | 8.2                          | 11.9                           | 8.6                    | 9.1            | 6.4             | 7.7                |
| Shrinkage  | 5.3                 | 5.9                          | 6.8                            | 11.4                   | 14.5           | 5.9             | 0.0                |
| Weighing Practices and Conditions  | 5.0                 | 8.5                          | 3.4                            | 5.7                    | 1.8            | 8.4             | 3.8                |
| Rail Grading   | 2.7                 | 2.4                          | 0.0                            | 2.9                    | 1.8            | 3.0             | 3.8                |
| Local Transportation   | 1.7                 | 1.4                          | 5.1                            | 8.6                    | 1.8            | 2.0             | 0.0                |
| Bruising and Injury, Insurance,<br>Buyer Bonding, Feeding Contracts,<br>Brand Inspection, Market<br>Deductions | 7.8                 | 8.7                          | 13.5                           | 8.6                    | 14.6           | 7.4             | 3.8                |
| Other  | 4.8                 | 5.4                          | 16.9                           | 2.9                    | 0.0            | 8.4             | 7.7                |

<sup>a</sup>Primary market outlet refers to the outlet the producer used most often or exclusively.

the questionnaires, however, suggest that some producers were more concerned with government involvement in the market place by way of trade regulations, price stabilization and credit programs than directly in the functional aspects of marketing.

**TABLE 8. PROBLEM SOURCES RATED FOR IMPORTANCE**

| Problem<br>Source            | First | Second | Third |
|------------------------------|-------|--------|-------|
| — percent of producers —     |       |        |       |
| Government                   | 20.5  | 6.8    | 6.8   |
| Wholesale and Retail Trade   | 13.3  | 10.8   | 8.3   |
| Packing Industry             | 15.5  | 10.2   | 6.4   |
| Grading System               | 8.7   | 6.8    | 7.7   |
| Freight Rates                | 6.6   | 6.5    | 4.4   |
| Commission Firms             | 6.7   | 4.5    | 3.0   |
| Public Stockyards            | 8.0   | 2.4    | 3.0   |
| Source of Market Information | 4.9   | 2.4    | 4.7   |
| Auction Markets              | 6.5   | 2.9    | 1.6   |
| Consumers                    | 3.3   | 2.9    | 3.4   |
| Cattle Futures Market        | 3.7   | 2.6    | 2.5   |
| Other                        | 2.4   | 0.7    | 0.8   |
| No Response                  | —     | 40.5   | 47.4  |

The packing industry and the wholesale and retail trade received almost identical ratings from producers. About 14 percent of them said these problem sources

were first in importance, 10.5 percent said they were second in importance, and about 7.5 percent said they were third in importance.

Important differences in problem source responses were not associated with enterprise type or size or province of origin.

### Problem Sources by Type of Market Outlet

If producers who use different market outlets have different marketing problems, then the sources of their problems should also differ. Table 9 relates important problem sources in marketing to the types of outlets used by producers.

Differences in the proportion of producers rating each problem source for importance are generally slight. Government, the packing industry, and the wholesale and retail trade were the three most important problem sources named by users of all outlets except order buyers and special or seasonal sales. To producers selling through order buyers, public stockyards were the second most important source of problems and the grading system was third. The grading system was also the third most important problem source for producers marketing through special or seasonal sales. This likely reflects the interest that producers have in the effect of the beef grading system on their product, but perhaps is also referring to feeder cattle selling where grades are not employed.

**TABLE 9. PROBLEM SOURCES RATED "MOST IMPORTANT" BY PRODUCERS AND CLASSIFIED BY PRIMARY MARKET OUTLET USED**

|                              | Public<br>Stockyard | Auction<br>Market | Special or<br>Seasonal<br>Sales | Dealers<br>or<br>Drovers | Order<br>Buyers | Packer<br>Buyers | Other<br>Producers |
|------------------------------|---------------------|-------------------|---------------------------------|--------------------------|-----------------|------------------|--------------------|
| — percent of producers —     |                     |                   |                                 |                          |                 |                  |                    |
| Government                   | 20.8                | 23.9              | 21.6                            | 16.7                     | 20.9            | 20.1             | 13.8               |
| Wholesale and Retail Trade   | 13.6                | 10.6              | 19.6                            | 16.7                     | 9.3             | 15.6             | 20.7               |
| Packing Industry             | 19.2                | 12.5              | 5.9                             | 16.7                     | 9.3             | 19.5             | 20.7               |
| Grading System               | 9.9                 | 6.8               | 11.8                            | 8.3                      | 11.6            | 9.5              | 13.8               |
| Public Stockyards            | 8.9                 | 6.8               | 5.9                             | 8.3                      | 16.3            | 10.0             | 3.4                |
| Auction Markets              | 6.7                 | 7.6               | 7.8                             | 8.3                      | 7.0             | 3.9              | 13.8               |
| Commission Firms             | 8.3                 | 7.6               | 3.9                             | 12.5                     | 4.7             | 3.4              | 3.4                |
| Freight Rates                | 6.9                 | 8.7               | 5.9                             | 0.0                      | 9.3             | 4.5              | 3.4                |
| Source of Market Information | 5.7                 | 4.9               | 7.8                             | 4.2                      | 4.7             | 4.5              | 0.0                |
| Consumers                    | 2.6                 | 4.4               | 5.9                             | 0.0                      | 2.3             | 3.4              | 6.9                |
| Cattle Futures Market        | 5.0                 | 3.8               | 2.0                             | 4.2                      | 2.3             | 2.2              | 0.0                |
| Other                        | 2.4                 | 2.4               | 2.0                             | 4.2                      | 2.3             | 3.4              | 0.0                |

## Ways to Improve Marketing

Producers were not very definite when asked to rate the importance of different ways to improve the marketing system (Table 10). While only 1.6 percent of them indicated that marketing could not be improved, the highest rating producers gave to any way of improvement was 26.8 percent in favor of more producer involvement. Another 24.2 percent chose more producer involvement as one of the three most important ways to improve marketing.

**TABLE 10. WAYS TO IMPROVE CATTLE MARKETING RATED FOR IMPORTANCE<sup>a</sup>**

| Way to<br>Improve                        | First | Second | Third |
|--|-------|--------|-------|
| — percent of producers —                 |       |        |       |
| More Producer Involvement                | 26.8  | 15.5   | 8.7   |
| Improved Management of<br>Market Outlets | 21.2  | 17.0   | 7.7   |
| Revision of Laws and<br>Regulations      | 15.8  | 10.4   | 9.0   |
| More Research                            | 9.3   | 9.4    | 11.7  |
| Other                                    | 14.8  | 4.0    | 4.9   |

<sup>a</sup>11.4 percent of the producers said they didn't know how cattle marketing could be improved, and another 1.6 percent said no improvement is possible.

Just over 21 percent of the producers indicated that improved management of market outlets was of primary importance, 15.8 percent of them thought the revision of laws and regulations to be first in importance, while only 9.3 percent considered more research the best way to improve marketing.

Other ways to improve were rated highest by 14.8 percent of the producers. Most of these thought less government involvement would help to solve marketing problems. However, there is some indication that this suggestion was intended for government programs that influence supply and demand rather than those that influence price discovery and efficient operation of the market place.

Classifying these results by enterprise size indicated that only uncertainty about means of improving the system is inversely related to enterprise size groups. Similarly, classification by enterprise type and province of origin revealed differences in the degree (but not ranking) of importance placed on the alternative means of improvement by producers with different enterprises.

## Ways to Improve Marketing by Type of Outlet

Table 11 gives the percentages of producers who rated ways to improve marketing in relation to the types of market outlets they use. The three major groups, public stockyard users, auction market users and those selling directly to plants, did not differ significantly in their opinions.

**TABLE 11. WAYS TO IMPROVE CATTLE MARKETING RATED "MOST IMPORTANT" BY PRODUCERS AND CLASSIFIED BY PRIMARY MARKET OUTLET USED**

| Way to Improve                   | Public Stockyard | Auction Market | Special or Seasonal Sales | Dealers or Drovers | Order Buyers | Packer Buyers | Other Producers |
|----------------------------------|------------------|----------------|---------------------------|--------------------|--------------|---------------|-----------------|
| — percent of producers —         |                  |                |                           |                    |              |               |                 |
| More Producer Involvement        | 26.9             | 24.7           | 30.0                      | 28.2               | 23.9         | 24.1          | 28.0            |
| Improved Management of Outlets   | 21.1             | 23.0           | 20.0                      | 10.3               | 21.7         | 20.4          | 28.0            |
| Revision of Laws and Regulations | 16.5             | 15.6           | 12.5                      | 12.8               | 21.7         | 17.8          | 12.0            |
| Other                            | 15.8             | 13.8           | 15.0                      | 15.4               | 10.9         | 15.7          | 12.0            |
| Don't Know                       | 9.9              | 12.5           | 10.0                      | 12.8               | 10.9         | 10.5          | 8.0             |
| More Research                    | 8.5              | 8.9            | 12.5                      | 12.8               | 10.9         | 9.9           | 12.0            |
| Cannot be Improved               | 1.3              | 1.5            | 0.0                       | 7.7                | 0.0          | 1.6           | 0.0             |
| Responses                        | 635              | 392            | 40                        | 39                 | 46           | 191           | 25              |

Only 10.3 percent of the producers selling through dealers and drovers rated the management of outlets as most important compared with percentages of 20 to 28 for the other groups. This is logically consistent with the fact that these producers do not use organized outlets and, therefore, may not be familiar with their management. Nearly eight percent of producers selling to dealers and drovers also said they did not think cattle marketing could be improved in contrast to percentages of zero to 1.6 for the other types of outlets.

## SUMMARY OF RESULTS AND IMPLICATIONS

Prairie beef producers were surveyed to develop a profile of the producer in terms of his marketing practices and behavior and as an evaluator of the marketing system. The results, although extremely general, should be useful to those responsible for improving the beef marketing system. Producer concerns and areas requiring more detailed examination have been identified.

Public stockyards, auction markets and direct sales to packing plants, in that order, are the most important market outlets for producers. Small producers use public stockyards to a greater degree than large producers, while large producers often market slaughter cattle directly to packing plants.

While location is one concern for producers in choosing their market outlets, they did not always market at their nearest outlet; this may suggest that efforts of the beef industry toward either centralization or decentralization of marketing should not be expected to succeed

on the basis of producers using distance as a factor for choice of market.

The survey confirms that radio is the primary source of market information used by producers. This emphasizes the need for accurate information, representative of the entire cattle market.

Producers' opinions of the performance of the cattle marketing system do not differ much by type of enterprise or enterprise size. Some differences are apparent among groups classified by enterprise size and market outlet used. This suggests that marketing in the three prairie provinces may develop along the same lines and a potential exists for the acceptance of marketing changes of a regional nature.

In general, producers feel that marketing problems are important, but it isn't clear whether or not they distinguish between market-performance deficiencies and inadequacies in returns arising from supply and demand factors<sup>5</sup>. If an understanding of this is essential to the development and acceptance of useful changes in the marketing system, then there is some indication that more marketing extension education should be carried out with respect to the differences between the effects on producer returns associated with these factors. Extension activities might also attempt to promote a greater awareness and understanding of the beef grading system and direct and indirect marketing costs, two other areas where a lack of knowledge on the part of the producer was revealed in other responses not reported here.

<sup>5</sup>The distinction was drawn to the attention of producers both in the questionnaire and in a covering letter.

Three problems that producers rate as primary are (1) pricing and selling procedures, (2) market information and (3) grades and grading. Acceptance of attempts to discuss, explore and experiment with ways of resolving these marketing problems would appear to be favorable. However, research is required to describe and understand why producers named these as primary problems.

If a trend toward larger production units is verified (as indicated by census data), the opinions of the large producers surveyed in this study may best reflect future marketing concerns. Examples are problems associated with direct forms of marketing and market information. Since radio market reports are by far the main source of market information for producers, it is imperative that the sources of these reports be representative of the market.

Producers were not very definite when asked to rate different ways to improve the marketing system. However, producers should be receptive to suggestions regarding improvements in the marketing system and, especially, to those entailing increased producer involvement. Changes arising directly from government action or implicitly involving government would not

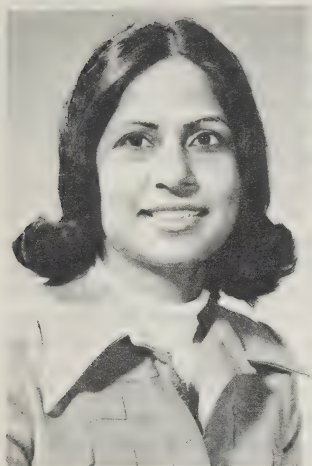
appear to be readily acceptable. It is not evident, though, what producers mean by more producer involvement as a means of improving marketing, i.e., producer control under existing legislation, co-operative efforts or more individual attention to the marketing decision.

Less than one third of producers regard government as a contributor to problems and the sources of dissatisfaction were related mainly to policies affecting demand and supply. However, two of the three most important "market performance" problems identified, grades and grading and pricing and selling procedures, are in areas where government has, or could have, considerable influence.

## REFERENCES

- [1] Ferber, Robert and P.J. Verdoorn, *Research Methods in Economics and Business*, The MacMillan Co., New York, 1962, pp. 258-260.
- [2] Johnson, R.D., *An Economic Evaluation of Alternative Marketing Methods for Fed Cattle*, SB 520, Nebraska Agricultural Experiment Station, University of Nebraska, June 1972, page 14.

# RECENT TRENDS IN FOOD PRICES IN CANADA



S. Barewal\*

*This article examines trends in retail food prices in the period between October 1971 and October 1976. Commodity groups analyzed include meats, poultry and eggs, dairy products, fruits and vegetables and fats and oils. Canadian prices are influenced not only by domestic conditions but also U.S. and world factors. A Canada - U.S. comparison shows that retail prices move in parallel for those commodities traded freely between the two countries (fruits and vegetables, meats) and those traded internationally (sugar).*

## INTRODUCTION

The rate of inflation in Canada, particularly with respect to food, was dramatic over the 1972-75 period (Figure 1). The retail food price index (1971 = 100) increased from 103.8 to 167.2, an increase of 61.1 percent, and the consumer price index for all items increased from 102.5 to 144.3, an increase of 40.8 percent.

Recognizing the adverse effects of these high rates of inflation on the Canadian economy, the federal government, in October 1975, launched a three-year anti-inflation program to keep the overall rate of price increase within a target level of eight percent in the first year, six percent in the second year and four percent in the third year. An Anti-inflation Board (AIB) was established, whose main objective was to control movements in prices, profits and wages in accordance with the guidelines set by the government. Although the prices received by farmers and fishermen for their products were generally exempt<sup>1</sup> from the guidelines, the AIB was expected to have a measurable impact on

food prices by its ability to constrain purchased farm input prices, and labor costs and profit margins at the food processing, distribution and retailing levels.

The main objective of this paper is to examine food-price movements in Canada over the 1971-76 period. Specifically, the objectives are: (1) to analyze food-price movements at various levels of the marketing system (farm, manufacturing and retail); (2) to examine monthly retail food-price movements for major commodity groups and to investigate factors that may account for the movements and (3) to compare retail food-price movements in Canada with those in the United States. An examination of food prices in the United States is of interest because it is Canada's most important trading partner and many food commodities (fruits and vegetables, meats, etc.) move relatively freely across the border.

## COMPARISON OF SELECTED INDEXES

An analysis of trends in the consumer price index (food) is greatly facilitated if the price movements at various marketing levels are visibly passed through to the retail level. This would also mean that prices at one level could be used as leading indicators for the next. An examination of three price indexes, the consumer price index (all food), the industry selling price index (food and

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<sup>1</sup>Marketing boards with substantial price-setting powers (i.e., dairy, broilers and eggs) were to be monitored to ensure that the "spirit" of the AIB guidelines were being followed.

beverages) and the farm product price index brings out the causal relationships existing among them. The indexes, however, are not strictly comparable because they do not measure prices of the same products or even of the same items, or carry the same weights in the "food basket". Further, the pass-through phenomena to the retail level may not be evident for those items where the raw material forms a small percentage of the retail value, e.g., bakery products. In these cases, other elements of the costs of production may overshadow the changes in the farm product index. An awareness of what each index measures is therefore necessary to understand and anticipate the pass-through effects.

**The Farm Product Price Index** (hereafter referred to as 'farm price index') measures changes in the average prices farmers receive from the sale of their products. The index is not a measure of pure price change but a measure of the change in average returns to farmers per unit of product marketed. Prices are usually obtained from terminal markets. Subsidies, bonuses and premiums are included in the prices, whereas storage, transportation and handling charges are excluded. The index does not consider prices of imported commodities but product sales to export as well as domestic markets are covered.

**The Industry Selling Price Index** (hereafter referred to as 'industry price index') (food and beverages) is a "measure of prices received by manufacturers for goods they sell and consequently elements of the purchaser's price which accrue to other industries do not belong in the price quotation entering into the index. Thus freight, insurance and taxes are excluded from price quotations"<sup>2</sup>. The emphasis in this index is on partly and highly-processed commodities and includes only prices of domestically-manufactured products. "This index is less volatile than the farm product index and reflects raw material price changes only with a lag and in a muted fashion, depending on the complexity of the production process and the nature of production such as the ratio of value added to gross output. The smaller this ratio the closer will the index trace the movements of the raw material prices and vice versa"<sup>3</sup>.

The **Consumer Price Index** (CPI) measures retail prices, including tax changes, for commodities regardless of origin of production. It is therefore moved by domestic as well as world market factors. Apart from reflecting changes in the industry price index (food and beverages), the CPI (food) takes into account changes in the value added of the transportation and distribution industries. Again, the lower the mark-up at the level of final sales the more closely will a particular index in the CPI reflect the corresponding industry price index.<sup>4</sup>

Figure 2 shows that raw material price changes are passing through the various stages of the marketing system in a muted fashion. Between October 1967 and October 1971 (four-year period) the farm price index, the industry price index (food and beverages) and the CPI (food) increased 0.7, 10.2 and 11.6 percent respectively. Over the following four years the same indexes increased 96.7, 56.3 and 65.3 percent respectively. The significantly greater increase in the farm product price between October 1971 and October 1975 was partly due to the rapid increase in the price of grains in this period. Although wheat carries a weight of about 16.1 percent in the farm price index, the weight of cereals and bakery products in the CPI (food) is 10.4 percent. A unit change in the price of wheat would affect the farm product index more than it would the CPI (food).

It thus appears that the composite indexes pose problems for the analyst in his efforts to trace the source of the inflationary trend. He must therefore look at the components of the indexes. The retail price index reflects price movements at other marketing levels best for items produced and traded primarily in the domestic market and for which value added in manufacturing is low relative to the value of the raw material, e.g., beef (Figure 3) and pork. Figures 4 and 5 show movements in the selected price indexes of dairy products and wheat. Marketing margins for dairy products are fairly constant and the three indexes move in unison. However, price index movements for wheat at the farm level are not fully reflected at the retail level (Figure 5). Indexes at the retail and industry level are for the price of cereals and bakery products whereas the farm price index is for the price of wheat. The low farmer's share of the retail value of breakfast cereals and bakery products (according to the Canadian Wheat Board the farmer's share of the price paid for a loaf of

<sup>2</sup>For a detailed discussion see Statistics Canada, *Industry Selling Price Indexes, 1956-68*, Catalogue No. 62-528.

<sup>3</sup>See paper presented at Conference Board Session, Toronto, February 13, 1975, by W.M. Illing, Statistics Canada.

<sup>4</sup>See footnote No. 3 above.

bread is 15 percent) and the two-price system for wheat (discussed in the following section) could probably explain the differences in the price movements at the three levels.

## RETAIL FOOD PRICES, OCTOBER 1971 – OCTOBER 1976

Several factors contributed to the rapid increase in Canadian retail food prices between 1971 and 1975 – general inflationary trends, consumer disposable income, adverse weather, international supply and demand factors and cost increases affecting particular commodities. International supply and demand pressures prevailed for grain, meat, sugar and oil prices. Increased consumer demand for beef was an important factor triggering the inflationary spiral in the food sector. Higher livestock numbers increased the demand for feed grains. This increased demand coupled with adverse weather and increased U.S.S.R. grain imports caused commodity prices to escalate in this period.

In Canada the food price index (1971 = 100) increased 51.3 percent from October 1972 to October 1975, but decreased 0.9 percent in the 12-month period after that. The index for food at home increased 50.9 percent (from 110.9 to 167.3) and that for food away from home increased 53.9 percent (from 108.9 to 167.6) between October 1972 and October 1975. The indexes moved in opposite directions over the October 1975 – October 1976 period; the index of food for home consumption decreased 2.6 percent and the index for food away from home increased seven percent.

### Meats

Beef is the largest single-expenditure item in the consumer's food basket, accounting for more than 15 percent of expenditures on food for home consumption<sup>5</sup>. Beef prices have been volatile in Canada as well as the United States (Figure 8). Prices in the two countries differed widely for short periods because of the controls imposed on trade in beef and livestock as compared with periods when there were no controls. In Canada the beef retail price index reached its peak in February 1974 (152.7), 51.5 percent above the October 1971 price (100.8). Beef prices trended downward after February 1974 and this trend continued into the period of operation of the anti-inflation program. Between October 1975 and October 1976 the beef

price index decreased from 146.5 to 122.0 (16.7 percent) in Canada and from 147.1 to 127.1 (13.6 percent) in the United States. The decline in beef prices in Canada was in part due to increased marketing of slaughter cattle and in part due to lower prices of U.S. and off-shore beef imports to North America<sup>6</sup>.

If prices of other components of the CPI for food for home consumption had remained constant during the first year of the anti-inflation program, then lower beef prices could be almost wholly credited with the 2.5 percent decline in the index over the 12-month period.

Of the meats, pork is consumed in the second largest amount in Canada and the United States (approximately 60 pounds per capita per year in Canada)<sup>7</sup>. Percentage increases in pork prices were higher than in the prices of other meats, with the pork price index in October 1975 (240.0) being nearly two and one half times that in October 1971 (102.2). Between October 1975 and October 1976 pork prices decreased 11.7 percent in Canada and 17 percent in the United States, mainly because of higher pork production in 1976 than in 1975 (Figure 9).

### Poultry and Eggs

In Canada poultry prices increased in 1973 and 1974. Since early 1975 chicken price increases have been more moderate. The price stability is largely attributable to the supply management of the provincial broiler marketing boards. Prices in the United States, on the other hand, were fairly volatile. There the poultry price index moved up from 100.9 in October 1971 to 206.8 in August 1973 and dropped to 125.0 in July 1974.

The 8.2-percent decrease in the poultry price index, from 203.8 to 187.1, during the first 12 months of the anti-inflation program was largely due to an increase in total supplies. Greater supplies resulted from increased domestic production, plus the fact that imports of carcass and live chicken in 1976 were approximately 2.2 and 3.5 times respectively those in 1976<sup>8</sup>. During the same 12-month period turkey prices remained stable relative to chicken prices.

<sup>6</sup> Agriculture Canada, Market Commentary, Animals and Animal Products, December 1976.

<sup>7</sup> Statistics Canada, Apparent Domestic Disappearance of Food in Canada, Catalogue No. 32-226.

<sup>8</sup> Agriculture Canada, Markets Information Services, "Poultry Market Report", Weekly Report Number 53, 1977.

<sup>5</sup> Statistics Canada, "1974 Urban Family Food Expenditure Survey".

The retail price of eggs in Canada varied little during the October 1975 – October 1976 period. This was probably due to the formula-pricing procedures of the Canadian Egg Marketing Agency (CEMA). The price of eggs in the United States, however, was not as stable (Figure 8).

### **Dairy Products**

In Canada dairy product prices were stable until November 1974. After that prices increased because of the higher costs of fluid and manufactured milk products like butter and cheese. In the last 12 months studied dairy product prices increased three percent, from 168.5 to 173.5 index points. The price of fluid milk increased only 1.6 percent, from 170.4 in October 1975 to 173.1 in October 1976. The price increases were small because the dairy industry, like the egg industry, is largely regulated by cost of production formulae. Also the cost of feed grains – a major input – has declined.

### **Fruits and Vegetables**

The long-term trend in the price of fruits and vegetables followed the general inflationary trend. A large percentage of fruits and vegetables consumed in Canada is imported from the United States and prices in the two countries tend to move together (Figure 10). Price fluctuations within any one 12-month period are usually due to seasonal factors. Between October 1975 and October 1976 the price index for fresh fruits increased 12.9 percent in Canada, from 144.2 to 162.8. This increase was mainly responsible for the 5.1-percent increase in the price index for fruits and vegetables as a whole. The index for both processed fruits and vegetables was stable over this one-year period. Price stability in this sector is the result of a relatively large pack from the 1975 crop and the availability of competitively-priced imports.

### **Fats and Oils (excluding butter)**

Domestic prices of fats and oils are heavily dependent on international prices of vegetable oils and animal fats. The upward pressure on oils and fats prices experienced in Canada in 1973 and 1974 was felt the world over. In 1974 alone the price index increased from 121.2 in January to 187.5 in December (54.7 percent). The highest level of prices during the period under study was recorded in February 1975 (191.9). After that, the price index declined gradually and from October 1975 to October 1976 it decreased 8.2 percent (178.5 to 163.8). A similar movement in prices was recorded in the United States. In fact, changes in prices are generally first

observed in the United States and Canadian prices follow these closely.

### **Cereals and Bakery Products**

The two-price system for wheat – a fixed price for domestic consumption and a competitive price for export – and the lower sugar and oil prices were responsible for moderating the increase in the price of cereals and bakery products (1.2 percent) in Canada.

While the price index in the United States had decreased much more than in Canada in the 1973-75 period, it was lower by 0.8 percent in October 1976 from its level 12 months earlier. This stability was probably the result of a good world wheat crop and lower sugar prices offsetting the rise in the cost of other inputs.

### **Other Foods**

In Canada about 80 percent of the sugar consumed is imported in the raw state and is further refined before being sold to wholesalers and manufacturers. Like fats and oils, sugar was subject to the vagaries of prices in the international market in 1974, with the retail price index in Canada peaking at 581.8 in December of that year. This was 479 percent higher than in October 1971. Prices in the United States also peaked in December 1974 and were 358.3 percent higher than in October 1971. Between October 1975 and October 1976 the retail price index of sugar decreased from 262.3 to 163.1 (37.8 percent) in Canada and from 223.6 to 163.0 (27.1 percent) in the United States.

Sugar is an important input in the soft-drink industry and the high prices of sugar were reflected in the trend of increasing prices of beverages. Unlike sugar the price index of beverages continued to increase through October 1976. Between October 1975 and October 1976 the price increased 7.9 percent in Canada and 25.5 percent in the United States. Coffee, which carries a weight of 29.8 percent in the price index of beverages, was the main contributor to the increase in Canada. The price of instant and roasted coffee increased 44.4 percent and 57.9 percent respectively during this period.

Thus far, this paper has reviewed retail prices in Canada. In the following section a basis is presented for grouping foods to indicate the main factors controlling food prices in Canada.

## CANADA — UNITED STATES PRICE MOVEMENTS<sup>9</sup>

During the five-year period studied the Economic Stabilization Program was in operation in the United States (from October 1971 to April 1974). The last year of the study period marked the first year of Canada's anti-inflation program, whose general objectives were similar to those of the Economic Stabilization Program. Traditionally, prices of food items whose production or prices are not controlled by either government tended to move parallel in the two countries.

An examination of Figure 7 shows that the rate of increase in the price index for food as a whole was greater in Canada than in the United States for the period 1971 to 1975. During the period October 1975 to October 1976 the gap was reduced. The earlier divergence was mainly due to the larger increase in the index for food away from home in Canada as compared with that in the United States.

The correlation between Canadian and U.S. month-to-month price movements (October 1971 to October 1976) were estimated for major food items. Results showed that prices of fruits and vegetables, meats and fats and oils are highly correlated (Table 1). Egg prices, on the other hand, showed a poor correlation. A priori reasoning would lead one to expect such a result. Prior to import restrictions being imposed in the form of the DES ban and later quotas in 1974, beef and pork moved freely across the border and if prices tended to rise rapidly in Canada, lower-priced U.S. meat was imported, closing the gap between Canadian and U.S. prices. Price movements of fruits and vegetables in the United States also exert a great influence on Canadian prices for these items, as about 40 percent of all fruits and vegetables sold in Canada are imported, mostly from the United States.

Prices of commodities traded in international markets also moved parallel in Canada and the United States. During the period October 1975 to October 1976 the index for sugar dropped from 262.3 to 163.1 in Canada,

TABLE 1. CORRELATION<sup>10</sup> OF FOOD PRICES, CANADA — UNITED STATES

| Item                  | Correlation                 |
|-----------------------|-----------------------------|
|                       | October 1971 — October 1976 |
| Fats and Oils         | 0.9814                      |
| Meats                 | 0.9386                      |
| Fruits and Vegetables | 0.9804                      |
| Eggs                  | 0.1571 <sup>11</sup>        |

and from 223.6 to 163.0 in the United States. For the same period, the index for oils and fats also dropped in both countries, in Canada from 178.5 to 163.8 and in the United States from 163.9 to 151.3.

Items that showed little correlation in monthly price movements in the United States and Canada were eggs and dairy products. In this regard it must be recognized that prices and production of these items are regulated by various marketing boards and agencies in Canada. The price of eggs was stable in Canada, but large fluctuations were noted in the United States, where the index rose from 146.0 in October 1975 to 170.6 in February 1976, dropped to 140.8 in June and rose again to 168.2 in September 1976. There was an upward trend in the price index for dairy products both in Canada and in the United States, though the percentage increase in price was greater in the United States over the 12-month period. The price index in Canada rose three percent from 168.5 in October 1975 and in the United States it increased 8.4 percent from its October 1975 level of 138.2.

## SUMMARY

A comparison of indexes at various levels of marketing in the food sector indicates that a significant decline in the farm product price index (October 1975 — October 1976) had a dampening effect on the industry selling price index and the consumer price index (food).

Between October 1975 and October 1976 the largest increases in prices were recorded for fish, beverages and fruits and vegetables, and the smallest increases were

<sup>9</sup> Although the consumer price indexes (food) for Canada and the United States are not the same measures because of differences in the content of the food basket, weighting given to each item, weighting of cities and outlets and specifications for the product, the differences are too small to deter a comparison of retail food price index movements in the two countries.

<sup>10</sup> Correlation measures the extent to which movements in one variable can be associated with movements in another. Values of correlation range from -1 to 1.

<sup>11</sup> CEMA was established in 1972 and in June 1973 it introduced the egg surplus removal program. A minimum-price structure was outlined in October 1973 and as of January 1974 it has accepted all unsold production in provincial markets at the intervention price. The correlation coefficient in Table 1 is for the period January 1974 — October 1976.

recorded for cereals and bakery products, dairy products and eggs.

Prices of red meats, poultry, sugar and fats and oils were substantially lower in October 1976 as compared with prices one year earlier.

A Canada — U.S. comparison of retail price movements shows a high correlation for commodities traded freely between the two countries (meats, fruits and vegetables and oils) as well as for those imported from other countries (sugar). Little correlation was observed in prices of items whose prices and production are regulated by marketing boards and agencies in either country (eggs and dairy products).

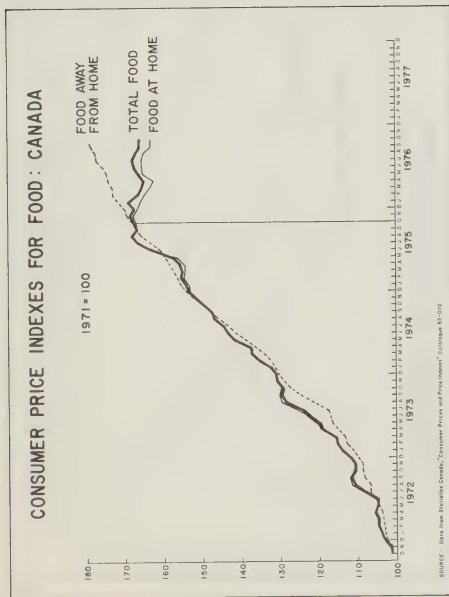


Figure 1

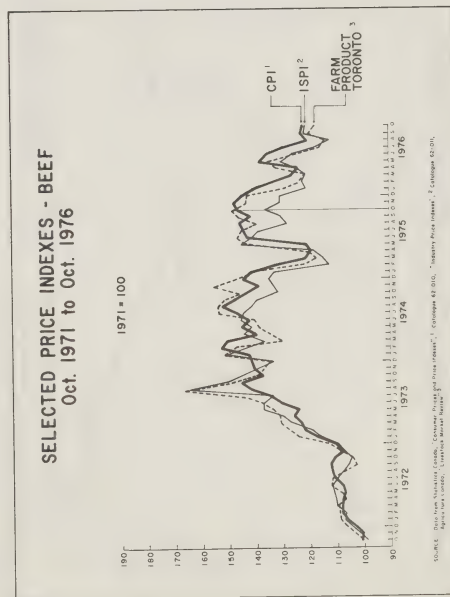


Figure 3

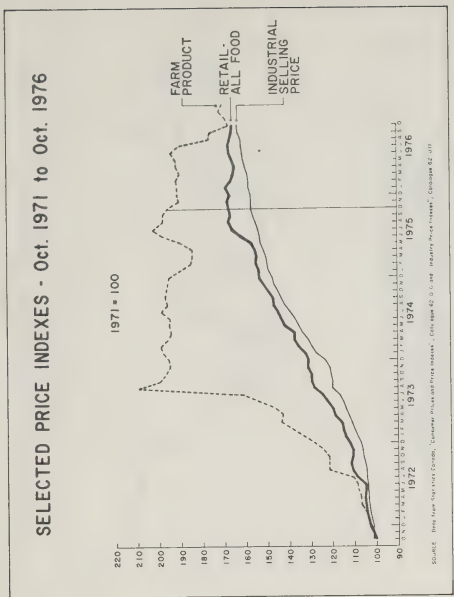


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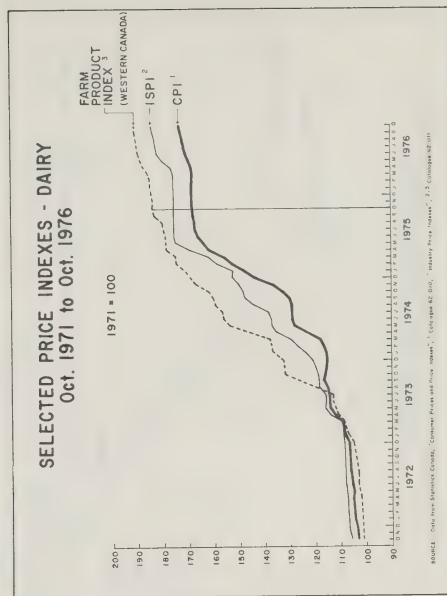


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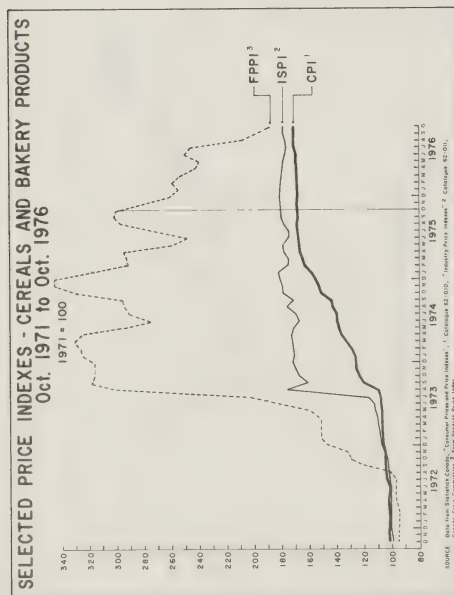


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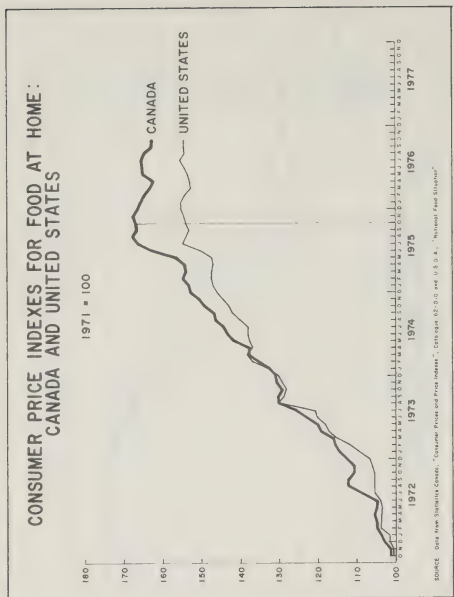


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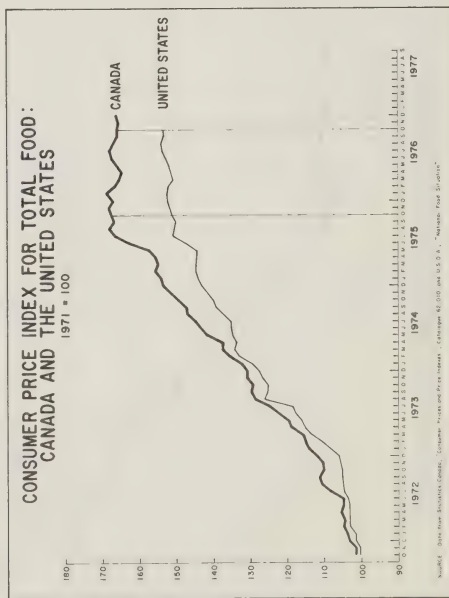


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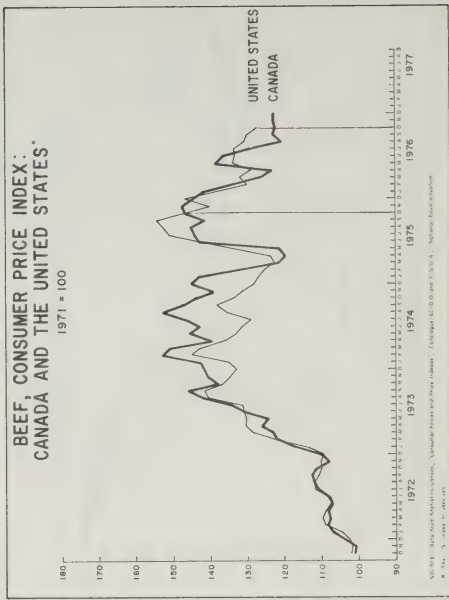


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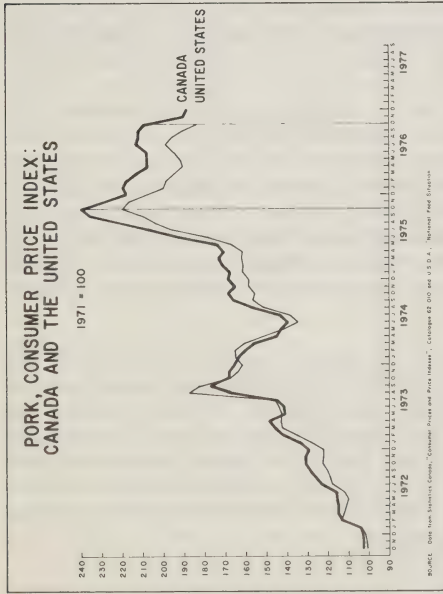


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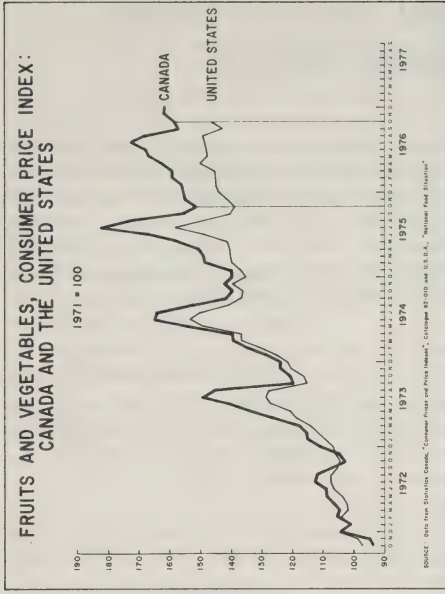


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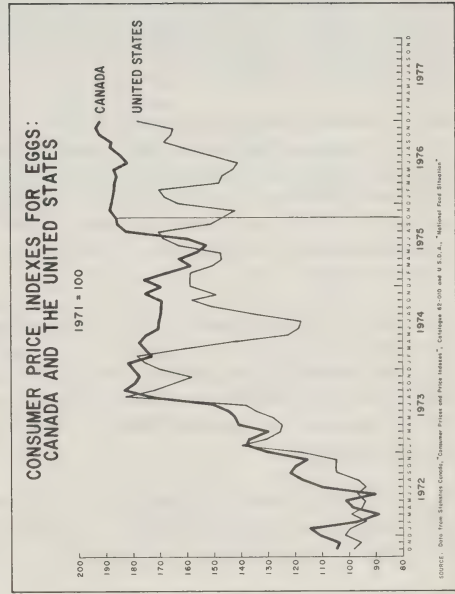


Figure 11

# RETROSPECTIVE ON FEDERAL DAIRY POLICY AND FEATURES OF NEW POLICY

*Events of the past two years have underscored the complexities of Canada's dairy industry. The following background information may assist in unravelling those complexities and in understanding the 1977-78 dairy program. The final section gives the important elements of the new dairy policy.*

## Historical Developments

The dairy industry contributes almost \$2 billion to the national economy. In 1976 payments to dairy farmers for their milk and cream accounted for about 16 percent of total farm cash receipts.

Milk in Canada is divided between two markets — fluid milk for drinking and industrial milk for manufacturing into butter, cheese, ice cream and other dairy products. Fluid milk production and sales fall under provincial jurisdiction. The federal government plays a role in co-ordinating and supporting industrial milk production across the country.

The goal of the federal dairy policy is to provide efficient producers of milk and cream with the opportunity of obtaining a fair return for their labor and investment and to provide consumers of dairy products with a continuous and adequate supply of dairy products of high quality.

In April 1975 the federal government announced a long-term dairy policy, which established a formula for setting base returns to farmers for industrial milk.

## Dairy Programs in the Past Two Years

At the beginning of the 1975-76 dairy year (April 1 to March 31) Agriculture Minister Eugene Whelan called for a five-percent increase in production. However, favorable weather and feed conditions, provincial incentives and an excessive allocation of market share quota resulted in milk shipments of 112.8 million hundredweight — 12.8 percent over target. The surplus production was made into butter and skim milk powder. World markets for dairy products were and still are depressed because of surpluses in other major exporting countries, especially in the European Economic Community.

Because the Canadian dairy policy is based on filling domestic demand and because it is costly to store and market skim milk powder and butter at a loss, milk

production had to be cut back in 1976-77. Producer market share quotas for industrial milk were cut by an average of 18 percent last April to bring production back into line with Canadian requirements. Individual market share quotas were administered on a monthly basis for much of the year and there was a stiff penalty of \$8.60 per hundredweight for overproduction.

During the year, as production was lowered and successfully remained within the total national quota, the Canadian Dairy Commission (CDC) eased its controls on production and added four million hundredweight of new quota with federal subsidy to be distributed to the producers who needed it most.

At the present time, the CDC estimates that production in the 1976-77 dairy year will be 97 million hundredweight, which is well in line with domestic requirements.

## Target Returns Level

The target returns level for 1977-78 will be \$11.86 per hundredweight, for milk testing 3.5 percent butterfat. In 1976-77 it was \$11.45. In 1975-76 it was \$11.02.

This level is calculated by the CDC according to the returns adjustment formula. It is based on farmers' average cash production costs and the consumer price index (used as a measure of changes in the value of a farmer's labor). The target returns level is also affected by judgment factors including the level of dairy product stocks, changes in returns to dairy producers in other countries and competitive processing costs outside of Canada.

Most of the target returns are paid to farmers by dairy manufacturers — creameries, cheese factories and other processors. But, in order to make processed dairy products affordable for consumers, the federal government pays part of the cost of producing industrial milk. This is paid as a direct subsidy to farmers by the CDC. The subsidy level for 1977-78 will be \$2.66 per hundredweight — the same as in the two previous dairy years.

## Product Support Prices

The support price for butter in 1977-78 will be \$1.18 and the skim milk powder support price will be 70 cents.

In effect, these support prices are the floor prices for these commodities in Canada. Wholesalers can buy them from the manufacturers at these prices or above. When the wholesale and retail trades have purchased all the butter and skim milk powder they require, the rest is bought by the Canadian Dairy Commission at the support prices. Indirectly, the support prices determine how much the manufacturers will pay dairy farmers for their industrial milk.

The federal government lends funds to the CDC for its dairy product purchases and for 1977-78 a loan limit of \$148 million has been authorized.

### **Export Equalization Facility**

Historically, Canadian dairy farmers have paid the loss on exported surplus dairy products year by year through levies on industrial milk shipments.

In October 1975 the federal government set up an export equalization fund. The fund enabled dairy farmers to spread the extraordinary losses incurred on exports over a five-year period.

Levies collected from producers have been applied against the losses on exports. However, because world butter and skim milk powder prices have been and are still very low in comparison with Canadian support prices, the debt in the fund has grown rapidly and now stands at about \$152 million.

Because the debt in the Canadian export fund has become an unreasonable burden for dairy farmers and because other countries are supporting their producers in direct competition with the Canadian industry, the federal government has decided to forgive the loans applicable to this debt.

### **Market Share Quotas**

The key to the federal dairy policy is effective supply management. The federal and provincial governments, the provincial milk boards and the producers themselves have agreed that production should not exceed domestic demand. Each group assumes a share of the responsibility for keeping production in line with demand.

It is the responsibility of the Canadian Milk Supply Management Committee (a body of representatives from the provincial governments, the provincial milk and cream boards and the Canadian Dairy Commission) to ensure that the national market share quota is adjusted when necessary in order to maintain a proper balance between production and market requirements.

Producers receive their individual market share quotas from their provincial milk and cream agencies.

Good weather, combined with the reasonable price being paid to producers and provincial incentives to increase production, boosted milk supplies in 1975-76 almost to the limit of the quotas.

Following this experience, the Milk Supply Management Committee set quotas very close to estimated demand for 1976-77. This has proved successful and the 1977-78 total quota of 105.6 million hundredweight is expected to result in production of 100 million hundredweight, which is the estimated demand. The difference between the demand and the total quota is a 'sleeve' to allow for quotas that are being transferred between farmers and for producers who are below their full quota for part of the year because of lowered production in their herds or other reasons.

### **MAIN FEATURES OF 1977-78 DAIRY POLICY**

The main features of the 1977-78 program, to be administered by the Canadian Dairy Commission, effective April 1, are:

- the debt in the export equalization account at March 31, 1977 (about \$152 million) to be written off by the federal government;
- federal subsidy payments on industrial milk and cream to remain at \$2.66 per hundredweight of milk at 3.5 percent butterfat (76 cents per pound of butterfat), and to be paid on deliveries up to 100 million hundredweight of market share quota;
- total market share quota for Canada to be 105.6 million hundredweight, with no interprovincial adjustment of quotas;
- an increase in the target returns level from \$11.45 to \$11.86 per hundredweight for industrial milk shipments under market share quota;
- the Canadian Dairy Commission is authorized to increase the support price for butter from \$1.08 per pound to \$1.18 and for skim milk powder from 68 cents per pound to 70 cents;
- maximum producer liability for export losses to be \$125 million;
- a contribution averaging 25 cents per hundredweight is expected in respect to fluid milk shipments to assist in covering some of the export costs for dairy

products — the details of such contributions to be worked out in consultation with the provinces;

- as a result of the debt write-off, the maximum producer liability of \$125 million and the contribution in respect to fluid milk, the in-quota levy has been lowered to \$1.20 per hundredweight to be paid on all industrial milk shipments within the 105.6 million-hundredweight-quota. (Last year's in-quota levy was \$1.35 and in-sleeve levy was \$8.60.)
- an over-quota levy of \$7 per hundredweight. (Last year's over-quota levy was \$8.60.);
- net returns to producers will increase by about 56 cents per hundredweight of industrial milk — for a producer of 300,000 pounds, that means an increased net return of close to \$1,700;
- cheese imports will be limited to 50 million pounds, unchanged from the 1976-77 dairy year; Canada is continuing its negotiations to resolve the problem of

subsidized cheese imports. To this end, Canada is pursuing its discussions with supplying countries;

- a vigorous market development program to be implemented by the Canadian Dairy Commission with a budget of up to \$4 million for sales promotion and market research;
- \$20 million is budgeted for the Canadian International Development Agency (CIDA) to purchase skim milk powder for international food aid;
- the Canadian government for the 1977-78 dairy program will spend up to \$477 million consisting of the following:
  - \$266 million in subsidy payments,
  - \$ 20 million for marketing costs,
  - \$ 15 million for export costs,
  - \$ 20 million for international food aid,
  - \$ 4 million for market promotion and research,
  - \$152 million to write off the export debt.

# PUBLICATIONS

## ECONOMICS BRANCH, AGRICULTURE CANADA

*Available from the Publications Manager, Room 303, Sir John Carling Building, Ottawa, Ontario, K1A 0C5.*

**Provincial Agricultural Legislation Up to 1977 – Western Provinces.** A.R. Jones. Publication No. 77/7. Various paging. Layman's summary of legislation affecting agriculture in B.C., Alta., Sask., and Man. For reference only. No legal value.

**List of Economics Material Published in 1976.** A. Trempe. Publication No. 77/8. p. Bilingual.

**Provincial Agricultural Legislation Up to 1977 – Ontario.** A.R. Jones. Publication No. 77/8. p. Layman's summary of legislation affecting agriculture in Ontario. For reference only. No legal value.

## UNIVERSITY OF GUELPH

*Available from the School of Agricultural Economics and Extension Education, Ontario Agricultural College, University of Guelph, Guelph, Ontario.*

**A National Food Policy.** January 1977, 97 p. Paper cover. Tables and figures. Bulletin No. AEEE/77/1.

**An Economic Analysis of Supply Management for the Canadian Beef Sector.** Larry Martin and Richard Haack. December 1976 75 p. Paper cover. Tables and figures. Bulletin No. AEEE/76/16.

**Distribution of Gains and Losses Resulting from Planning Legislation: The Compensation-Betterment Problem.** W. Van Vuuren. August 1976. 124 p. Paper cover. A study of agricultural land use in Ontario. Bulletin No. AE/76/8.

**An Analysis of the Amended Agricultural Stabilization Act With Special Reference to the Livestock Industry.** Larry Martin. September 1976. 31 p. Paper cover. Bulletin No. AEEE/76/11.

## MISCELLANEOUS PUBLICATIONS

**Plan of Action for Co-operation between Canada and Latin America.** New forms of co-operation for middle-income countries. Address by Paul Gérin-Lajoie, President, Canadian International Development Agency, in Rio de Janeiro, November 1976. Bilingual, 28 p. each language. *Write: Information Division, Communications Branch, CIDA, 122 Bank St., Ottawa, K1A 0G4.*

**Manitoba Hog Producers' Marketing Board Twelfth Annual Report.** Year Ended December 1976. 20 p. Graphs, charts, figures. *Available from Manitoba Hog Producers' Marketing Board, 750 Marion St., St. Boniface, Manitoba.*

**Canadian Egg Marketing Agency Report to the Fourth Producers' Conference.** 96 p. Paper cover. Bilingual. Graphs and figures. *Write: CEMA, Room 507, 116 Albert St., Ottawa, K1P 5G3.*

**Canadian Livestock Feed Board Annual Report.** Crop Year 1975-76. 96 p. Paper cover. Bilingual. Tables and figures. *Write: Canadian Livestock Feed Board, P.O. Box 2250, St. Laurent Postal Station, Montreal, Quebec, H4L 4Y7.*

**Living Together, A Study of Regional Disparities.** Economic Council of Canada. April 1977. 251 p. Catalogue No. EC 22-54/1977. *Write: Printing and Publishing, Supply and Services Canada, Ottawa, K1A 0S9. Price: \$5.50 Canada; \$6.60 other countries.*



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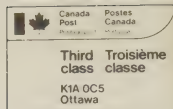


## CONVERSION FACTORS FOR METRIC SYSTEM

| Imperial units         | Approximate<br>conversion factor     | Results in:                          |
|------------------------|--------------------------------------|--------------------------------------|
| <b>LINEAR</b>          |                                      |                                      |
| inch                   | x 25                                 | millimetre (mm)                      |
| foot                   | x 30                                 | centimetre (cm)                      |
| yard                   | x 0.9                                | metre (m)                            |
| mile                   | x 1.6                                | kilometre (km)                       |
| <b>AREA</b>            |                                      |                                      |
| square inch            | x 6.5                                | square centimetre (cm <sup>2</sup> ) |
| square foot            | x 0.09                               | square metre (m <sup>2</sup> )       |
| acre                   | x 0.40                               | hectare (ha)                         |
| <b>VOLUME</b>          |                                      |                                      |
| cubic inch             | x 16                                 | cubic centimetre (cm <sup>3</sup> )  |
| cubic foot             | x 28                                 | cubic decimetre (dm <sup>3</sup> )   |
| cubic yard             | x 0.8                                | cubic metre (m <sup>3</sup> )        |
| fluid ounce            | x 28                                 | millilitre (ml)                      |
| pint                   | x 0.57                               | litre (ℓ)                            |
| quart                  | x 1.1                                | litre (ℓ)                            |
| gallon                 | x 4.5                                | litre (ℓ)                            |
| <b>WEIGHT</b>          |                                      |                                      |
| ounce                  | x 28                                 | gram (g)                             |
| pound                  | x 0.45                               | kilogram (kg)                        |
| short ton (2000 lb)    | x 0.9                                | tonne (t)                            |
| <b>TEMPERATURE</b>     |                                      |                                      |
| degrees Fahrenheit     | (° F-32) x 0.56<br>or (° F-32) x 5/9 | degrees Celsius (° C)                |
| <b>PRESSURE</b>        |                                      |                                      |
| pounds per square inch | x 6.9                                | kilopascal (kPa)                     |
| <b>POWER</b>           |                                      |                                      |
| horsepower             | x 746<br>x 0.75                      | watt (W)<br>kilowatt (kW)            |
| <b>SPEED</b>           |                                      |                                      |
| feet per second        | x 0.30                               | metres per second (m/s)              |
| miles per hour         | x 1.6                                | kilometres per hour (km/h)           |
| <b>AGRICULTURE</b>     |                                      |                                      |
| gallons per acre       | x 11.23                              | litres per hectare (ℓ/ha)            |
| quarts per acre        | x 2.8                                | litres per hectare (ℓ/ha)            |
| pints per acre         | x 1.4                                | litres per hectare (ℓ/ha)            |
| fluid ounces per acre  | x 70                                 | millilitres per hectare (ml/ha)      |
| tons per acre          | x 2.24                               | tonnes per hectare (t/ha)            |
| pounds per acre        | x 1.12                               | kilograms per hectare (kg/ha)        |
| ounces per acre        | x 70                                 | grams per hectare (g/ha)             |
| plants per acre        | x 2.47                               | plants per hectare (plants/ha)       |

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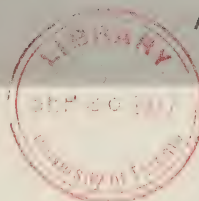
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# CANADIAN FARM ECONOMICS

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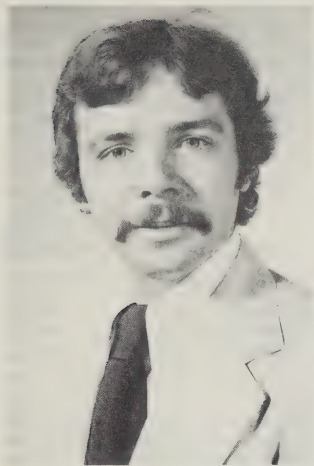
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# INSTABILITY IN THE WORLD BEEF MARKET



G.E. Pugh\*

*Instability in world beef prices results largely from the restrictive import policies of some importing countries, the nature of the cattle cycle, and the large-scale orientation to the export market of beef production in exporting countries. Should none of the above factors change, the same pressure experienced in Canada, during 1975 and 1976, from beef imports can be expected to recur.*

## INTRODUCTION

Instability of prices has been a characteristic of the Canadian beef industry for many years. Prices rise and fall in response, among other factors, to fluctuating levels of marketings as the beef cycle runs its course. This price instability is also a characteristic of beef industries in other countries. Given relatively open Canadian trade policies with respect to beef and the nature of world beef trade, beef market problems in these other countries have influenced Canadian markets and contributed to Canadian problems. This was most evident during 1975 and 1976. Unfortunately, given a continuation of present trading relationships and trade policies, a similar situation is likely to recur.

The disruption of world markets by relatively cheap beef suggests that instability in individual countries adds up to instability on a world scale; moreover, the instability of one country can be transmitted to another. This paper discusses world beef trade and examines the causes of the price instability. This entails examining the characteristics and trends in world beef trade, analyzing factors affecting production cycles in both exporting and importing countries and discussing economic policies with respect to world beef trade. The final

section explains the nature of instability in world beef prices.

## PATTERN OF WORLD BEEF TRADE

The pattern of world beef trade is such that on the one hand there is a group of predominantly importing countries and on the other a group of exporting countries (Table 1). The importing countries, the United States, Canada, Japan and the EEC-9, which annually account for over 80 percent of world imports, have well-developed cattle industries themselves. In North America the cattle industry is geared toward the production of high-cost, grain-fed beef. The exporting countries, Australia, New Zealand, Argentina and Brazil, which annually account for over 60 percent of world exports, are geared to the production of relatively low-cost, grass-fed, manufacturing-quality beef. In North America this beef does not compete directly with the higher-quality beef, but rather with beef of the same quality. Manufacturing-quality beef in North America is obtained from cull beef or dairy cows, low-quality steers and heifers or the front ends of higher-quality steers and heifers. In Japan it competes directly with dairy-steer beef, which is an important component of production. In Europe it competes directly with most of the production, since little grain-fed beef is produced.

The world trade pattern has also been influenced by the existence of foot-and-mouth disease in some countries

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\*G.E. Pugh is an economist in the Marketing and Trade Division, Economics Branch, Agriculture Canada, Ottawa.

**TABLE 1. BEEF PRODUCTION, CONSUMPTION AND TRADE, SELECTED COUNTRIES, (1971-76 Average, Carcass Weight)**

| Importing Countries | Production  | Consumption       | Imports              | Imports Relative to Production |
|---------------------|-------------|-------------------|----------------------|--------------------------------|
|                     | — mil. lb — | — lb per capita — | — mil. lb —          | — percent —                    |
| U.S.                | 24,090.8    | 119.2             | 1,901.3              | 7.9                            |
| EEC-9               | 13,731.9    | 55.3              | 1,237.6 <sup>a</sup> | 9.0                            |
| Japan               | 641.8       | 8.2               | 229.2                | 35.7                           |
| Canada              | 2,077.5     | 98.0              | 147.5                | 7.1                            |

| Exporting Countries | Production  | Consumption <sup>b</sup> | Exports     | Exports Relative to Production |
|---------------------|-------------|--------------------------|-------------|--------------------------------|
|                     | — mil. lb — | — lb per capita —        | — mil. lb — | — percent —                    |
| Australia           | 3,378.6     | 106.2                    | 1,710.9     | 50.6                           |
| New Zealand         | 969.8       | 116.6                    | 649.1       | 67.0                           |
| Argentina           | 5,074.5     | 158.2                    | 1,026.7     | 20.2                           |

<sup>a</sup>Excludes intra-EEC trade.

<sup>b</sup>1971-75 average only.

Sources: Australian Meat Board, Annual Report (various issues).  
Commonwealth Secretariat, Meat & Dairy Produce Bulletin (various issues).  
National Meat Board of Argentina.  
Statistics Canada, Imports by Commodity.  
U.S.D.A., FAS, Foreign Agriculture Circular, Livestock & Meat.  
U.S.D.A., ERS, Livestock and Meat Situation (various issues).

and its absence in others. Its existence in South America and parts of Europe and its absence in North America, Japan and Oceania means that trade predominates among North America, Japan and Oceania on the one hand and between South America and Europe on the other. While this is so, and while the following analysis concentrates on the North America-Oceania trade relationship, international trade in beef must be considered in a multilateral context. Connections between the international markets ensure that changes in any one sector of trade have repercussions throughout the entire market.

## TRENDS IN WORLD BEEF TRADE

International trade in beef on a large scale is a relatively recent phenomenon. Trends in world beef trade to a large extent reflect the development of the beef industries in the importing countries. Prior to 1957, trade was dominated by the United Kingdom and its possessions in the Mediterranean and the Pacific. Rising per capita incomes in North America and continental Europe after World War II, however, were fostering the development of specialized beef industries. In 1957 a cyclical downturn in U.S. beef production, resulting from herd build-up, caused that country to make its first significant importation of manufacturing beef. This marked the beginning of the United States' rise to

dominance in the international beef market and the beginning of the rapid development of the beef industries in Australia and New Zealand, which were able to enter the U.S. market on the health grounds mentioned above. Continued rising consumption of beef in the United States and a demand shift in favor of manufacturing-quality beef were the driving forces behind this rapid expansion. For example, from 1945 to 1957 Australian exports averaged 212.7 million pounds product weight per year, of which Britain took, on average, 78 percent. From 1971 to 1976 exports averaged 1,025.8 million pounds, of which the United States took 60 percent.

Trends in Canadian importation from Oceania roughly parallel those in the United States, although Canada did not become a major importer until the late 1960s and early 1970s (Table 2). Of significance to Canada has been that as the beef industries in the United States and Canada have developed, the influence of the U.S. industry on Canada's has become of primary importance. Canada has been able to share in the expansion of the U.S. market for manufacturing beef and has a distinct advantage over the Oceanic countries in being able to ship fresh or chilled beef at lower transportation rates. Canada also ships significant numbers of live cows to the United States. The trade flow is two-way; however, Canada imports significant quantities of beef

TABLE 2. CANADIAN IMPORTS AND EXPORTS OF BEEF

| Year              | Imports     |             |               |       | Exports       |       |
|-------------------|-------------|-------------|---------------|-------|---------------|-------|
|                   | Australia   | New Zealand | United States | Total | United States | Total |
|                   | — mil. lb — |             |               |       | — mil. lb—    |       |
| 1960              | 2.7         | 8.3         | 6.4           | 17.4  | 18.0          | 18.4  |
| 1961              | 3.1         | 8.1         | 5.0           | 16.2  | 29.0          | 29.3  |
| 1962              | 10.1        | 9.2         | 3.7           | 23.0  | 19.7          | 20.3  |
| 1963              | 9.4         | 11.7        | 2.8           | 23.9  | 17.2          | 17.9  |
| 1964              | 4.8         | 4.8         | 4.0           | 17.6  | 28.4          | 31.6  |
| 1965              | 2.8         | 2.0         | 2.5           | 7.3   | 72.0          | 78.8  |
| 1966              | 3.7         | 2.7         | 4.2           | 10.6  | 56.4          | 59.2  |
| 1967              | 8.5         | 5.5         | 7.0           | 21.0  | 23.3          | 24.2  |
| 1968              | 9.9         | 6.4         | 3.5           | 19.8  | 44.3          | 46.0  |
| 1969              | 25.9        | 74.8        | 4.4           | 105.1 | 42.9          | 43.9  |
| 1970              | 50.6        | 73.3        | 2.3           | 125.2 | 78.1          | 79.2  |
| 1971              | 22.2        | 61.2        | 17.5          | 100.9 | 74.7          | 76.3  |
| 1972              | 48.2        | 47.8        | 26.9          | 122.9 | 58.8          | 67.6  |
| 1973              | 61.4        | 48.2        | 34.8          | 144.4 | 55.5          | 58.4  |
| 1974              | 43.4        | 54.7        | 17.6          | 115.7 | 36.0          | 37.3  |
| 1975              | 61.2        | 53.9        | 10.9          | 126.0 | 22.9          | 31.3  |
| 1976              | 108.8       | 78.4        | 24.3          | 209.5 | 82.7          | 86.9  |
| 1977 <sup>a</sup> | 11.2        | 16.1        | 3.4           | 30.7  | 27.6          | 28.6  |

<sup>a</sup>January-March 1977, *Trade of Canada*, to the end of May 1977, *Livestock and Meat Trade Report*, indicate total imports of 62.9 mil. lb (including cured, pickled, cooked, and canned) and exports of 49.2 mil. lb.

Source: Statistics Canada: *Trade of Canada, Imports by Commodity*.  
Statistics Canada: *Trade of Canada, Exports by Commodity*.

and live cattle for slaughter from the United States, most of it higher-quality beef.

Concurrent with the rise to dominance of the United States in the international market has been the relative decline of the United Kingdom. Though the United Kingdom remains a significant importer of beef, its relative influence on world markets has moderated since it joined the EEC and adopted the Common Agricultural Policy. In addition, as the United Kingdom has strengthened ties with continental Europe, the policy of Commonwealth preference has been phased out. Moreover, because the EEC does not have the same regulations regarding importation of beef from countries with endemic foot-and-mouth disease, the main source of supply for manufacturing beef for the EEC and thus the United Kingdom has shifted from Oceania to countries in South America, from which transportation costs are lower.

Another characteristic of world beef trade since the early 1960s has been the rising importance of Japan as an importer. By 1971 Japan had become the world's second largest importer of beef. This growth has been closely tied to government policy with respect to the domestic beef industry. Stated government policy is to achieve 80 percent self-sufficiency in beef production.

However, Japan's limited land base, the strong relationship between the beef and dairy industries and high feed costs have meant that beef production has not expanded at the desired rate and has fluctuated on a yearly basis. The result has been the tendency to increase imports. Actual year-to-year import-quota levels therefore have varied with domestic requirements, which have largely been determined by domestic price levels. More will be said later on Japanese import policy.

## FACTORS AFFECTING SUPPLIES IN THE EXPORTING COUNTRIES

The New Zealand and Australian beef industries are geared mainly toward the production of beef for export. Over the past five years New Zealand has exported, on average, over 60 percent of its production, while Australia has exported 52 percent of its output. As noted earlier, the recent, rapid development of the beef industries has been a common feature in Australia and New Zealand. The New Zealand beef cattle population increased from 3.3 million head in 1961 to 6.8 million head in 1976. The total cattle population, both beef and dairy, was 9.8 million head in 1976. In Australia the beef cattle population doubled from 1960 to 1976, from 16.7 million head to 33.4 million head. In relation to domestic consumption in these countries, this represents tremendous export capacity.

The development of the beef industries in Australia and New Zealand and the factors affecting their development are roughly parallel. Traditionally, exports of beef were to Britain, which from the late 19th century onward took the largest portion of Australia's and New Zealand's surplus beef. The opening of the U.S. market, however, transformed the orientation of the industries, and since that time the welfare of the domestic industries has hinged on the export market.

This dependence on the overseas market has been institutionalized to a certain extent by the pricing procedures in the two countries, particularly in New Zealand. Among the several marketing options that producers have in New Zealand, the most popular is to sell under a system of schedule pricing. The schedule-pricing system is a method of marketing cattle into the export market. It is a derived price, being calculated from the estimated receipts at the point of overseas sale by deducting the costs and the margins between. The costs include killing and processing charges to FOB and freight. It is assessed for various grades of beef, taking into account the above costs, and is worked out on a dressed-weight basis at the processing-plant door. The schedule is issued weekly by the export companies and reflects what they are willing to pay for various types and grades of beef. This pricing system, then, puts the producer in direct contact with the overseas market. In Australia as well, export companies are dominant forces in the market.

When export prices are relatively high, as they were during most of the 1960s and early 1970s, expansion is encouraged. When prices fall, as they did in 1975, producers are caught with large excess supplies. Price movements from 1968 to 1976 are presented in Table 3.

Another factor affecting the cattle industries in these two countries has been the relative profitability of the sheep industry. Since sheep compete for the same pasturage as cattle, the rapid expansion of the cattle industry has largely been the result of favorable beef prices relative to those of wool, lamb and mutton. In New Zealand, for example, where cattle often graze with sheep, the ratio of cattle to sheep on pasture has increased from 1:16 in 1950 to 1:10 in 1974. In both countries the sheep industries are still important. New Zealand's earnings from lamb exports in 1975-76 were, in fact, greater than those from beef.

Weather has a large impact on beef production in Oceania, particularly in Australia. Drought has at times forced more livestock, particularly cows, on the market than would normally have been marketed. This was

**TABLE 3. PRICE MOVEMENTS IN EXPORTING COUNTRIES**

| Year | Australia <sup>a</sup> | New Zealand <sup>b</sup> |
|------|------------------------|--------------------------|
|      | — Aust. cents/lb —     | — N.Z. cents/lb —        |
| 1968 | 21.6                   | 16.2                     |
| 1969 | 22.2                   | 16.8                     |
| 1970 | 22.6                   | 21.7                     |
| 1971 | 23.4                   | 21.3                     |
| 1972 | 23.8                   | 20.7                     |
| 1973 | 27.5                   | 28.4                     |
| 1974 | 31.5                   | 20.7                     |
| 1975 | 10.6                   | 11.2                     |
| 1976 | 11.6                   | 20.5 <sup>c</sup>        |

<sup>a</sup>Cows, 200/300 Kg Export Quality, Sydney.

<sup>b</sup>Cows, M Grade, 140.5 Kg and over, Schedule Price.

<sup>c</sup>Reflects New Zealand Meat Board's support price.

Sources: Australian Meat Board, *Annual Report* (various issues).  
New Zealand Meat Board, *Meat Producer* (various issues).

particularly evident in 1972 and early 1973 and was important again in 1975 and 1976. The effect of drought on world prices will, of course, be most serious during periods of already heavy marketings, such as 1975 or 1976, but would also adversely affect prices during other periods.

## FACTORS AFFECTING PRODUCTION IN NORTH AMERICA

North Americans are unique in a world context in that relatively higher income levels and relatively lower grain costs allow them to indulge their preference for grain-fed beef. Beef finished on grain at an age that is young relative to the ages of cattle marketed in other countries is more tender, but is, as a result, more highly priced. The North American preference for this quality of beef has led to the development of a "two-tiered" cattle industry. At the primary level is the cow-calf industry, where farmers with cow herds produce calves that are an input for the secondary level or feedlot-finishing industry. As a result of this structure, the relative profitability of the cow-calf sector depends directly upon the profit situation in the finishing sector. Prices received for finished cattle discounted by feed costs largely determine the prices producers are willing to pay for feeder calves. Thus during periods of high prices for finished cattle, assuming feed costs remain the same, producers are willing to bid more for feeder cattle. Conversely they will bid less when finished cattle prices are lower.

Since the price paid for feeder cattle determines the profit situation of cow-calf producers, cycles in fed

cattle prices and numbers are an important element in determining cycles in beef cow numbers. In addition to the cyclical tendency for producers to overexpand or overcontract their herds in response to price situations within the industry, cyclical movements in cattle production and prices can be modified by external forces such as sharp changes in production costs or in the consumer demand for beef. In the current cycle, for example, the sharp increase in feed grain prices in 1973-74 was passed back to the cow-calf sector in the form of lower feeder cattle prices. This in turn triggered increased cow and heifer slaughter and the depressed incomes in the beef industry at the present time.

A review of cattle marketing in Canada over recent years suggests that price and income problems in the cattle industry stem at least as much from the incidence of higher grain prices as from a previously excessive build-up in cattle numbers.

Given the long and relatively open border that Canada shares with the United States and the size of the U.S. market, the Canadian beef industry is strongly influenced by that of the United States. Historically, except from 1965 to 1969 when Canadian cattle numbers contracted while those in the United States expanded, the Canadian beef cattle cycle has followed that of the United States (Figures 1 and 2). Price differentials between the two countries (adjusted for transportation costs and exchange rate differentials) in both the feeder and slaughter markets have tended to be eliminated by trade flows.

It is within the context of this historical dependence of the Canadian market on the U.S. market that the issue of trade-restricting policy becomes of paramount importance to Canada. The most important of these policies from Canada's point of view is the U.S. Meat Import Law (PL88-482). Its indirect effect on imports of Oceanic beef into Canada, as well as Canada's ability to compensate for this effect by exporting to the United States, has contributed to the market instability of the past two years.

## ECONOMIC POLICY WITH RESPECT TO WORLD BEEF TRADE

Since the importing countries themselves have well-developed beef industries, in times of over-supply on the world market most of these countries have import-restricting policies to maintain domestic price stability.

The U.S. Meat Import Law, the means whereby the United States regulates beef imports, became necessary

with the rapid expansion of imports after 1957. The purpose of the law is "to control the growth of imports so as not to place undue stress on domestic cattle prices" and "to institute such action as is required by overriding economic or national security interests of the United States, giving special weight to the importance to the Nation of the economic well-being of the domestic livestock industry", etc.<sup>1</sup> This legislation became law on August 22, 1964, following a sharp rise in imports and a decline in cattle prices. Under the law, imports of fresh, chilled or frozen beef, veal, mutton and goat meat are allowed to grow, from a base of 725.4 million pounds, at the same rate as domestic production of these meats from the 1959-63 base period to the most recent three-year average figure (including an estimate of production in that year). A 10-percent margin is allowed so that quotas are triggered only when imports are expected to exceed the adjusted base level by 10 percent.

The Secretary of Agriculture is required to announce, at the beginning of each year, the trigger levels of imports for that year. Further, he is required to make quarterly estimates of the amount of meat that, if not for the law, would enter the country in that calendar year. If the estimate exceeds the trigger level, the President is required to invoke quotas on imports subject to the law. At that time negotiations take place with the exporting countries to determine their relative share of the quota.

The President may also suspend the quota or increase the quantity in the face of overriding national interest. That is, the President is required by law to invoke the quotas if imports exceed the trigger level but he is also empowered simultaneously, to suspend them. Such was the case in both 1973 and 1974 when escalating domestic beef prices were deemed sufficient cause to suspend the quotas.

Japan also has policies to restrict imports of beef. One goal of Japanese agricultural policy is to achieve 80-percent self-sufficiency in beef. As a result, imports are subject to an Import Quota System. Prior to April 1975, import-quota levels had been determined by domestic price movements and had been allowed to expand moderately in line with the program of import liberalization. Since that time, however, new beef stabilization arrangements have been made. Broadly, these arrangements are designed to maintain prices to producers around the mean of specified price ranges through

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<sup>1</sup>See U.S.D.A., ERS, February 1975. *Livestock & Meat Situation*, pp. 31-32.

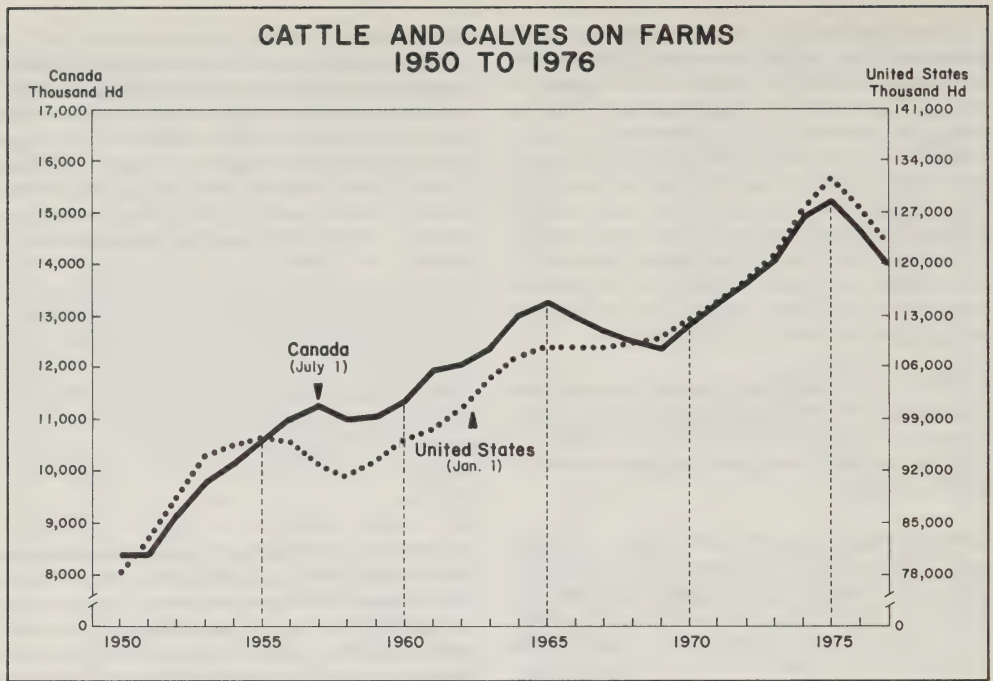


Figure 1

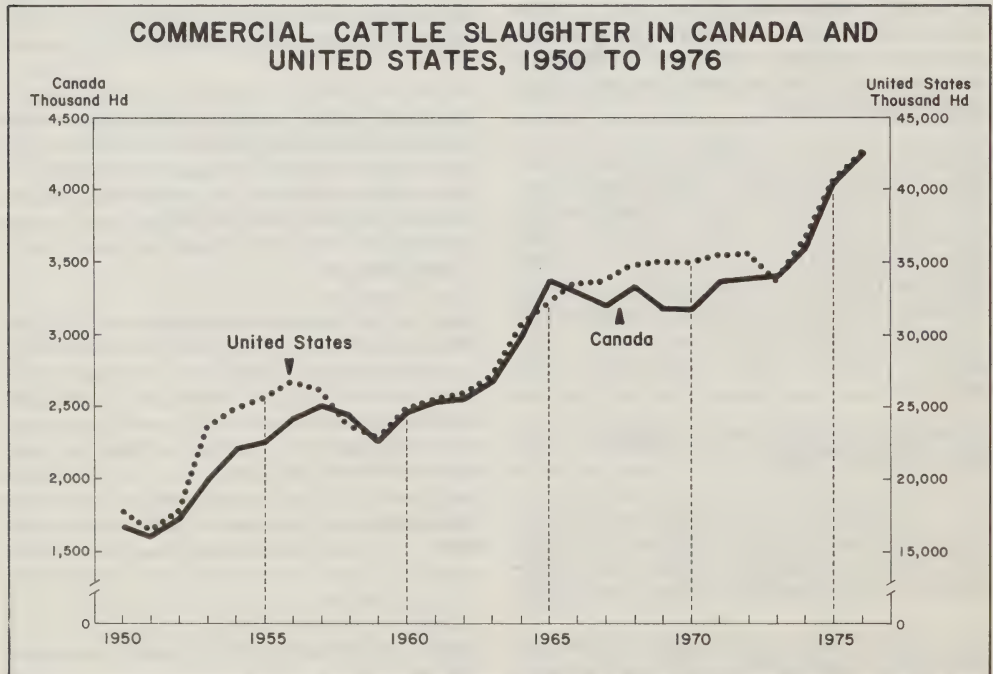


Figure 2

variation in import levels and through intervention in the market by the Livestock Industry Promotion Corporation, a semi-governmental body.

EEC import policy with respect to beef also results in restrictions on trade. Under provisions of the Common Agricultural Policy, price stabilization policies have taken a variety of forms such as variable import levies and duties, and intervention buying and stockpiling. These, however, failed to prevent prices from falling below the guide price and in addition resulted in large build-ups in intervention stocks. This led to a ban on imports in 1974, except for those negotiated under GATT agreements. An Exim (Export-import) scheme was introduced in June 1975, allowing importers to import up to 50,000 tonnes of beef provided they exported a corresponding amount. This scheme was replaced in January 1976 by a new *Jumelage* Scheme, linking imports from third countries with purchases of intervention stocks of beef. This program was itself replaced by a new scheme of variable import levies beginning April 1, 1977. These levies range from 0 to 114 percent of the basic levy, where the basic levy is the difference between the EEC price and the world price.<sup>2</sup>

## THE NATURE OF WORLD BEEF MARKET INSTABILITY

The main feature of the world beef market since 1957 has been that the import requirements of the importing countries have been residual to their own domestic supplies, while on the exporting side exports have been a major portion of production. This would be an unstable situation in terms of price even if the cattle cycles in each of the importing countries were out of phase with those in other countries so that rising supplies in one country would be counter-balanced by falling supplies in another. This would mean that even though a fairly constant level of import demand would be maintained on a world level, the exporting countries still run the risk of outstripping demand by overproducing and hence depressing prices. This situation could be even more unstable, however, should the production cycles in the importing countries come into phase. In this case, if the cycles were in an expansionary phase, that is, a phase of herd build-up, import demand would, initially, increase tremendously. If the cycles coincided in a liquidation phase, that is, during a period of herd reduction, there would be large surpluses of beef to be cleared on world markets.

There is considerable evidence that cattle cycles in Europe and North America came into phase during the early 1970s during an expansion phase, and that the subsequent liquidation phase beginning in late 1974 was the source of the depressed world market and the exceptionally low beef prices in the exporting countries throughout 1975 and 1976.

Briefly, the phenomenon of the cattle cycle is characterized by the cyclical rising and falling of beef production and prices and cattle numbers. An expansion phase is triggered by producers responding to a relatively profitable situation in the industry by withholding heifers and reducing cow culling to augment breeding herds, which in turn accentuates the price rise. If they are not first discouraged by other factors, producers tend to over-produce relative to demand and prices eventually fall as beef output from the expanded herd increases. This induces a producer response in reverse and a liquidation phase results in which herds are culled and replacement heifers marketed, thus reducing prices even further.

Tendencies to overproduce and overliquidate relative to demand and the consequent effect on price are not the only factors that contribute to producer expectation as to future profitability. As mentioned before, input costs are a major factor in the North American beef industry. A sustained increase in feed costs would have the same effect as falling prices in initiating a liquidation phase in the feedlot sector of the industry. This in turn initiates a liquidation phase in the cow-calf sector as feeder cattle demand is reduced and prices fall.

In relation to developments in recent years it would appear that the initial stimulus to expansion of the beef industries in Australia and New Zealand came in 1957 as a result of a cyclical downturn in U.S. beef production. A relatively profitable situation in the export market was maintained through the 1960s by offsetting beef production cycles in Europe and North America. While beef production in North America increased in the mid-to-late 1960s, production in Europe declined. This in effect provided an incentive for exporting countries to maintain expansion of their herds. In the early 1970s the expectation of future relative profitability coincided in almost every beef-producing country in the world. The result was a synchronization of cattle cycles in the expansion phase in these countries. The response was a levelling or downturn in slaughterings and production in 1972 and 1973.

In late 1973 and early 1974, production in most countries started to increase as a result of herd build-up

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<sup>2</sup>For a more detailed description of this scheme see AGRA Europe, Dec. 31, 1976.

in the previous two years. Beef prices in response showed signs of easing and in late 1974 began to plummet. Exaggerating the price decline in addition to increased supplies was the fact that demand had eased on a world-wide basis in the face of relatively stable or falling net consumer income resulting from inflationary pressure and slow economic growth. In North America this combined with increased marketings in the face of high feed grain prices. Faced with greatly reduced demand for feeders, cow-calf producers began liquidating their herds, which accentuated the price decline.

Australia and New Zealand had shown tendencies, in the past, to "store" cattle on grass when beef prices abroad declined. In 1975 and particularly in 1976, however, drought forced considerable herd reduction. Supplies of beef increased and prices in Australia and New Zealand reached record low levels.

The existence of the U.S. Meat Import Law and barriers to the EEC and Japanese markets set the stage for a system of differential pricing into world markets with higher prices in the United States and other markets on the one hand and lower prices in unprotected markets on the other. In effect, the unprotected markets are forced to absorb the excess production unable to gain entry to the protected markets. This system has been reinforced from time to time by the policy of some exporting countries, particularly Australia, to prorate shares of the U.S. market to individual firms on the basis of sales to other markets. The stated objective of the program is to diversify market outlets, but in effect it is to avoid violating the limits of the U.S. Meat Import Law<sup>3</sup>. The net result has been the incentive to register sales in other markets without due regard to price.

Heavy importing activity by Canada in 1975 and 1976 was judged to be responsible for price distortion in the Canadian market and resulted in quotas being applied on imports in the latter part of both years. The quota applied in August 1974 was extended to December 31, 1975 and then removed. However, heavy importing activity resumed in 1976. The relative price spread between the Canadian and U.S. markets led to an agreement between the Canadian government and the Australian and New Zealand meat boards to limit export prices to a level \$.06 (Can.) under those prevailing in the United States. But heavy importing continued throughout the summer and Canada reintroduced quotas in mid-October. Since there was no evidence that there would be a decrease in import activity in 1977, quotas were negotiated for that entire year.

## SUMMARY

Present world trade relationships in beef are largely the product of only the last 20 years. Trade between North America and Oceania grew out of requirements for manufacturing-quality beef as a result of a cyclical downturn in U.S. beef production in 1957. Australia and New Zealand became the major suppliers of the U.S. market as a result of their disease-free status. Beef production in both countries grew phenomenally in response to export demand, spurred by the relative unprofitability of sheep production. Although by the mid-1960s beef production had expanded beyond that required to supply the U.S. market, relative shortages elsewhere in the world, particularly in Japan, saved the industries in Australia and New Zealand from immediate price declines. Moreover, in the early 1970s beef cycles in major importing countries synchronized during an expansion phase, creating shortages that raised beef prices to record levels. The simultaneous downturn in world beef cycles, however, and consequent world surpluses of beef combined with import restricting policies in some importing countries, designed to stabilize domestic prices, forced world prices down and forced the cattle industries in Australia and New Zealand into an extremely painful period of adjustment, a period which continues at the present time.

In retrospect, the rationalization of production in Australia and New Zealand would have been less painful domestically, and less disruptive internationally, had production been forced down in the mid-1960s. As it was, it would seem that these countries overexpanded their productive capacity relative to world demand.

Since demand for foreign beef in the importing countries depends on the beef cycles in those countries, and if the exporting countries exhibit the same behavior in terms of rapid expansion of production in response to higher export prices and if importing countries retain import restricting policies, then the price instability in the world beef market can be expected to continue.

From Canada's point of view, this means that pressure on domestic prices from low-priced imports can be expected to occur again in future.

## REFERENCES

Australian Meat Board, Forty-first Annual Report, Year ended June 30, 1976. Fortieth Annual Report, Year ended June 30, 1975. The Australian Meat and Livestock Industries, Occasional publication, 1973.

<sup>3</sup>See 41st Annual Report of Australian Meat Board, p. 41.

Bureau of Agricultural Economics, Canberra. Meat: Situation and Outlook, 1974, 1975 and 1976.

Breimyer, Harold, "Observations on the Cattle Cycle" Agricultural Economics Research, Volume V11, No. 1, Jan. 1955.

Byrne, A.C. and Berenger, T.H., "The Beef and Veal Situation in the EEC", Meat: Situation and Outlook, BAE Canberra, 1975.

Early, Suzanne, "History of the Meat Import Law and Program for 1975", Livestock and Meat Situation, February 1975.

Johnson, D. Gale, "World Agriculture, Commodity Policy, and Price Variability", American Journal of Agricultural Economics, Vol. 57, No. 5, Dec., 1975.

New Zealand Meat Producers Marketing Board. "The Organization of the Beef Industry in New Zealand" Presentation to the OECD Symposium, Towards A More Efficient Beef Chain, Paris, January 10, 13, 1977. Also, the board's 52nd Annual Report and Statement of Accounts for year ended September 30, 1974.

Prosser, P.B., "The Market for Beef in Japan", Quarterly Review of Agricultural Economics, Vol. XXVI, No. 2, April 1973.

Reeves, G.W. and Hayman, A.H., "Demand and Supply Forces in the World Beef Market", Quarterly Review of Agricultural Economics, Vol. XXVIII, No. 3, July 1975.

Sault, J.L. and McCumstie, R., Developments in the Japanese Beef Market: Their Implications for Production Systems in the Australian Beef Cattle Industry. Beef Research Report No. 17, BAE., Canberra.

# CANADA'S FRUIT AND VEGETABLE PROCESSING INDUSTRY



*In 1974 Canada's fruit and vegetable processing industry bought \$200 million worth of domestic and imported fruit and vegetables. The industry's sales increased from \$320 million in 1961 to \$865 million in 1974.*



*R.W. Anderson & R.D. Daniel\**

## INTRODUCTION

The fruit and vegetable processing sector is a market for approximately one third of Canada's horticultural produce, a major supplier of processed food products and an important employer. This article discusses its location, structure, mode of operation and future development.

Fruit and vegetable processing, a major component of the food production economy, is diversified and complex. It encompasses canning, freezing, dehydrating, frying, pickling and the manufacture of food flavors and food adjuncts such as blending spices and mixing powders for instant drinks. A large variety of fruit and vegetables in both a raw and semi-processed form are used. While most material is produced domestically, large quantities are imported.

In 1974 the processing sector used \$175.7 million worth of domestic and \$13.9 million worth of imported fruit and vegetables. By volume this represented 487.3 million

pounds of fruit and 2,629.8 million pounds of vegetables produced in Canada plus imports of 27.3 million pounds of fruit and 86.7 million pounds of vegetables (excluding carrots, cucumbers and mushrooms)<sup>1</sup>. A substantial volume of semi-processed and processed fruit and vegetables is also imported each year for other sectors of the food system.

From 1963 to 1974 the volume of canned and frozen product remained relatively constant while per capita production decreased (Tables 1 and 2). The most significant drop was in canned fruit, falling from 8.76 pounds per capita in 1966 to 4.16 in 1974. Production of canned vegetables decreased from 33.84 in 1968 to 28.70 in 1974. Frozen vegetable production on the other hand increased from 3.44 in 1963 to 7.63 in 1974. Frozen fruit did not enjoy this popularity as per capita production dropped from 3.12 in 1967 to 1.95 in 1974.

Despite the decrease in the volume of fruit handled and the relatively constant volume of vegetables, the value of shipments of the industries' own goods increased from

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<sup>1</sup> Statistics Canada, Cat. No. 32-023, Vol. 3, No. 9.

**TABLE 1. FROZEN FRUIT AND VEGETABLE PACK 1963-74**

| Year | Fruit Pack <sup>a</sup> |                         | Vegetable Pack <sup>c</sup> |                         |
|------|-------------------------|-------------------------|-----------------------------|-------------------------|
|      | Total                   | Per Capita <sup>b</sup> | Total                       | Per Capita <sup>b</sup> |
|      | — 000 lb —              | — lb —                  | — 000 lb —                  | — lb —                  |
| 1963 | 40,905                  | 2.18                    | 64,651                      | 3.44                    |
| 1964 | 55,511                  | 2.90                    | 80,181                      | 4.19                    |
| 1965 | 52,271                  | 2.74                    | 100,589                     | 5.27                    |
| 1966 | 60,542                  | 3.05                    | 107,053                     | 5.39                    |
| 1967 | 63,154                  | 3.12                    | 115,255                     | 5.70                    |
| 1968 | 53,262                  | 2.95                    | 121,768                     | 5.92                    |
| 1969 | 55,925                  | 2.68                    | 116,422                     | 5.57                    |
| 1970 | 57,499                  | 2.71                    | 136,514                     | 6.44                    |
| 1971 | 57,892                  | 2.70                    | 107,907                     | 5.03                    |
| 1972 | 51,603                  | 2.38                    | 129,027                     | 5.49                    |
| 1973 | 52,059                  | 2.37                    | 151,221                     | 6.88                    |
| 1974 | 43,584                  | 1.95                    | 170,243                     | 7.63                    |

<sup>a</sup>Includes apples, apricots, blueberries, cherries, peaches, plums, raspberries, rhubarb, strawberries and others. Competition from imports and a strong fresh market have limited the fruit pack.

<sup>b</sup>Per capita pack as determined by dividing total pack by total population on January 1 of each year. Assumes that on average no carry-over exists.

<sup>c</sup>Includes asparagus, broccoli, brussels sprouts, beans, carrots, cauliflower, corn, peas and others.

Source: Statistics Canada, Canned and Frozen Processed Foods, Cat. No. 32—212.

**TABLE 2. CANNED FRUIT AND VEGETABLE PACK, 1963-74**

| Year | Fruit Pack <sup>a</sup> |                         | Vegetable Pack <sup>b</sup> |                         |
|------|-------------------------|-------------------------|-----------------------------|-------------------------|
|      | Total                   | Per Capita <sup>c</sup> | Total                       | Per Capita <sup>c</sup> |
|      | — 000 lb —              | — lb —                  | — 000 lb —                  | — lb —                  |
| 1963 | 139,380                 | 7.42                    | 510,831                     | 27.19                   |
| 1964 | 157,887                 | 8.25                    | 598,791                     | 31.28                   |
| 1965 | 134,899                 | 7.06                    | 636,045                     | 33.29                   |
| 1966 | 173,969                 | 8.76                    | 641,551                     | 32.31                   |
| 1967 | 140,064                 | 6.92                    | 619,356                     | 30.62                   |
| 1968 | 141,146                 | 6.86                    | 696,393                     | 33.84                   |
| 1969 | 148,217                 | 7.10                    | 584,452                     | 27.90                   |
| 1970 | 133,139                 | 6.29                    | 625,715                     | 29.54                   |
| 1971 | 127,499                 | 5.94                    | 660,121                     | 30.57                   |
| 1972 | 106,653                 | 4.91                    | 571,962                     | 26.33                   |
| 1973 | 121,381                 | 5.52                    | 642,098                     | 29.21                   |
| 1974 | 92,789                  | 4.16                    | 640,271                     | 28.70                   |

<sup>a</sup>Includes apples, apricots, blueberries, cherries, fruit cocktail, loganberries, peaches, pears, plums, raspberries, rhubarb, strawberries and others. Peaches and apricots have led the recent decline.

<sup>b</sup>Includes asparagus, beans, beets, carrots, corn, mixed vegetables, mushrooms, peas, pumpkins, sauerkraut, spinach, tomatoes and others.

<sup>c</sup>Per capita pack determined by dividing total pack by total population on January 1 of each year.

Source: Statistics Canada, Canned and Frozen Processed Foods, Cat. No. 32—212.

\$319.9 million in 1961 to \$865.2 million in 1974 (Table 3). The value added<sup>2</sup> increased from \$123.5 million to \$346.5 million and wages increased from \$54.9 million to \$146.4 million<sup>3</sup>. Although inflation was a factor, the volume of frozen and canned products shipped by domestic processors did increase (Tables 4 and 5). Jams, jellies and marmalades as a group were an exception to the increase in the total value of sales (Table 6).

The number of employees in the processing sector decreased slightly in response to automation and consolidation from a high of 20,558 in 1966 to 19,200 in 1974 (Table 3). This 1974 level is, however, above that of 1961 and constitutes an important area of full-time employment. Many operations that left the industry employed mostly part-time labor and thus had little impact on year-round employment. While new technology is continually being introduced, major changes in the employment level are not anticipated at this time.

In 1974 Canada had approximately 245 firms processing fruit and vegetables in 281 plants<sup>4</sup>. Twenty-four of these firms had two or more plants. Fifty-one plants canned only one product and 26 were freezing only one product. Sixty-one of the 245 firms had freezing-only operations and 22 were both canning and freezing. Some multi-plant firms also had both freezing and canning operations.

## PLANT LOCATION

There are 107 of Canada's 209 fruit and vegetable canning plants in Ontario (Table 7). Although south-western Ontario and the Toronto area together have 57 plants, the Belleville, Hamilton and Niagara areas are also major processing centres. Quebec has 64 plants, 58 of which are in the Montreal area and 15 of British Columbia's 22 plants are in the Vancouver and Fraser Valley districts.

<sup>2</sup>Value added is the shipments of goods of own manufacture plus net change in inventory of goods in process and finished goods, less cost of materials and supplies used, fuel and electricity. (Source: Statistics Canada, Fruit and Vegetable Processing Industries, Cat. No. 32-218).

<sup>3</sup>Using 1971 as a base period and the food and fruit and vegetable component of the Consumer Price Index, the increase in real terms has been from \$408.1 million in 1961 to \$603.0 million in 1974. Value added in real terms increased from \$227.4 million to \$251.3 million and wages from \$101.2 million to \$106.2 million.

<sup>4</sup>In some situations a firm may still be operating as a separate entity when it has been purchased by another firm in the industry. Thus there may be fewer than 245 firms.

**TABLE 3. FRUIT AND VEGETABLE PROCESSING INDUSTRIES — VALUE OF SHIPMENTS, VALUE ADDED, NUMBER OF EMPLOYEES AND EMPLOYEE WAGES, 1961-72**

| Year | Value of<br>Shipment of<br>Own Goods | Value<br>Added | No. of<br>Employees | Employee<br>Wages |
|------|--------------------------------------|----------------|---------------------|-------------------|
|      | — 000 —                              | — \$000 —      |                     | — \$000 —         |
| 1961 | 319,940                              | 123,483        | 17,523              | 54,948            |
| 1962 | 347,299                              | 136,732        | 18,258              | 59,670            |
| 1963 | 379,036                              | 145,446        | 17,567              | 60,442            |
| 1964 | 414,755                              | 165,817        | 18,813              | 66,842            |
| 1965 | 435,753                              | 176,100        | 19,645              | 73,835            |
| 1966 | 470,298                              | 193,796        | 20,558              | 81,379            |
| 1967 | 499,261                              | 203,039        | 20,029              | 85,929            |
| 1968 | 509,986                              | 208,009        | 19,343              | 90,073            |
| 1969 | 536,623                              | 219,099        | 19,348              | 96,385            |
| 1970 | 544,338                              | 210,534        | 18,876              | 100,527           |
| 1971 | 567,686                              | 224,632        | 18,185              | 106,160           |
| 1972 | 631,320                              | 250,766        | 18,260              | 115,919           |
| 1973 | 716,325                              | 282,605        | 18,886              | 128,961           |
| 1974 | 865,259                              | 346,542        | 19,200              | 146,446           |

Source: Statistics Canada, Fruit and Vegetable Processing Industries, Cat. No. 32-218.

Thirty-four of Canada's 83 fruit and vegetable freezing plants are located in Ontario with a fairly even distribution throughout the canning areas. British Columbia has 21 freezing plants, 19 of which are in the Vancouver and Fraser Valley areas. Quebec has 12 plants with 10 in the Quebec City area and only two in the Montreal district.

Dehydration is less significant than canning or freezing. There are 13 plants spread over six provinces (Table 7).

Most canning and freezing plants are located close to major population centres for several reasons. Most population centres offer an attractive environment com-

pared with other parts of Canada. This, while making living conditions attractive, is also conducive to fruit and vegetable production. Having the processor close to the raw product source and final market is also economically attractive. In addition, the centres are a good source of accessible labor. Recently, however, some processors have had to comply with pollution regulations. Some have made adjustments to their plants and remained at their locations while others, unable to physically or economically make adjustments, have had to move to less populated areas.

## RAW AND SEMI-PROCESSED PRODUCT SUPPLY

Processors buy domestically-grown raw product through open markets, contracts and company production (Table 8). Open-market purchases are most frequent for fruit, especially blueberries, apples and raspberries. Onions are also often purchased on the open market. Producers use contracts, especially those supplying seed and harvesting services, almost exclusively for a number of vegetables including peas, beans, corn, cucumbers and cauliflower. To extend and level out the season, processing firms grow some products (mostly peas, corn and beans) for their own processing. Early and late plantings are usually lower yielding and have a higher risk of crop losses; consequently producers are reluctant to plant during these periods. Processors have a greater number of enterprises over which they can spread their risk and they believe that benefits of extending the season outweigh the disadvantages. By growing some of their own crops in periods of limited supply, processors can keep plants operating.

Many firms also use imported raw products. An unpublished survey by Agriculture Canada shows that 33 of 54 plants responding to a question on the source of supply indicate the use of imported raw or semi-processed products for further processing. The survey also shows that Canadian-owned firms import material as frequently as foreign-owned ones.

## EXPORTS AND IMPORTS

The volume of canned vegetables and fruit exported from Canada is small in relation to the total pack. Some major canned vegetable exports are asparagus, green and waxed beans, corn, peas and tomato juice. Canned fruit exports include apples (solid pack and juice), cherries and pears. In 1974 Canada exported approximately 3.5 percent of all canned vegetables and 13 percent of all canned fruit.

**TABLE 4. SHIPMENTS OF DOMESTICALLY-PRODUCED FROZEN FRUIT AND VEGETABLES**

| Year | Fruit      |           | Vegetables  |           |
|------|------------|-----------|-------------|-----------|
|      | Volume     | Value     | Volume      | Value     |
|      | — lb —     | — \$000 — | — lb —      | — \$000 — |
| 1968 | 34,986,837 | 9,833     | 315,185,942 | 49,610    |
| 1969 | 37,336,523 | 11,036    | 387,053,055 | 63,774    |
| 1970 | 35,933,434 | 11,075    | 397,487,509 | 63,936    |
| 1971 | 38,492,561 | 11,695    | 374,883,775 | 62,116    |
| 1972 | 37,680,229 | 13,004    | 425,685,808 | 74,779    |
| 1973 | 41,320,750 | 16,144    | 485,771,753 | 88,386    |
| 1974 | 37,683,406 | 16,307    | 506,370,364 | 111,545   |

Source: Statistics Canada, Fruit and Vegetable Processing Industries, Cat. No. 32-218.

**TABLE 5. SHIPMENTS OF CANNED FRUIT, VEGETABLES, JAMS, SOUPS, TOMATO JUICE AND PICKLES BY VOLUME**

| Year       | Canned Fruits | Canned Vegetables | Jams, Jellies and Marmalades <sup>a</sup> | Canned Soups (All Kinds) | Catsups | Tomato Juice | Pickles, Relishes and Sauces <sup>b</sup> |
|------------|---------------|-------------------|---|--------------------------|---------|--------------|---|
| — 000 lb — |               |                   |   |                          |         |              |   |
| 1961       | 150,513       | 550,050           | 99,913                                    | X                        | X       | 181,802      | 125,100                                   |
| 1962       | 164,775       | 560,207           | 95,684                                    | X                        | X       | 208,001      | 139,123                                   |
| 1963       | 156,540       | 575,872           | 99,381                                    | X                        | X       | 193,635      | 204,017                                   |
| 1964       | 159,900       | 621,568           | 101,185                                   | X                        | X       | 195,009      | 137,167                                   |
| 1965       | 143,169       | 661,756           | 105,041                                   | 306,940                  | 70,363  | 210,837      | 157,720                                   |
| 1966       | 144,410       | 635,839           | 106,704                                   | 320,468                  | 72,807  | 186,968      | 158,977                                   |
| 1967       | 151,887       | 644,746           | 93,275                                    | 324,568                  | 77,877  | 193,419      | 148,962                                   |
| 1968       | 150,402       | 653,049           | 82,820                                    | 303,105                  | 78,411  | 173,582      | 168,780                                   |
| 1969       | 142,365       | 612,228           | 78,806                                    | 345,303                  | 79,003  | 176,289      | 171,554                                   |
| 1970       | 134,900       | 583,909           | 75,554                                    | 343,272                  | 81,988  | 148,318      | 168,252                                   |
| 1971       | 131,082       | 610,287           | 62,550                                    | 344,564                  | 78,046  | 159,705      | 159,538                                   |
| 1972       | 138,805       | 604,117           | 54,956                                    | 370,140                  | 96,984  | 181,316      | 170,417                                   |
| 1973       | 129,172       | 591,761           | 58,608                                    | 388,771                  | 104,990 | 179,822      | 187,088                                   |
| 1974       | 123,378       | 613,714           | 56,736                                    | 401,587                  | X       | 198,237      | 193,610                                   |

<sup>a</sup>Shipment decline appears to have resulted from increased prices.

<sup>b</sup>The growth in shipments reflects the growth in the fast-food industry.

Source: Statistics Canada, Fruit and Vegetable Processing Industries, Cat. No. 32—218.

X—Denotes data not available.

Blueberries and raspberries are the major frozen fruits exported. The main markets are the United States and Europe.

Domestic processors must compete with significant quantities of imports. In 1974 this country imported about 34 percent of the canned vegetables and 77

percent of the canned fruits (processed and semi-processed) available to consumers. The major vegetables were asparagus, baked beans, carrots, corn, mushrooms, tomatoes and tomato products; fruit included apples, apricots, peaches, pears and strawberries (Table 9).

**TABLE 6. SHIPMENTS OF CANNED FRUIT, VEGETABLES, JAMS, SOUPS, TOMATO JUICE AND PICKLES BY VALUE**

| Year       | Canned Fruit | Canned Vegetables | Jams, Jellies and Marmalades | Canned Soups (All Kinds) | Catsups | Tomato Juice | Pickles, Relishes and Sauces |
|------------|--------------|-------------------|------------------------------|--------------------------|---------|--------------|------------------------------|
| — \$ 000 — |              |                   |                              |                          |         |              |                              |
| 1961       | 23,267       | 73,067            | 20,293                       | X                        | X       | 15,526       | 24,572                       |
| 1962       | 26,502       | 74,348            | 19,736                       | X                        | X       | 16,030       | 27,409                       |
| 1963       | 27,507       | 77,191            | 23,101                       | X                        | X       | 16,302       | 29,335                       |
| 1964       | 29,281       | 84,031            | 24,410                       | X                        | X       | 18,769       | 30,361                       |
| 1965       | 26,236       | 92,130            | 23,538                       | 54,890                   | 15,399  | 19,717       | 34,012                       |
| 1966       | 26,573       | 97,561            | 23,337                       | 58,805                   | 15,835  | 17,965       | 38,237                       |
| 1967       | 28,707       | 100,622           | 21,330                       | 61,562                   | 17,297  | 20,622       | 37,989                       |
| 1968       | 28,453       | 112,572           | 19,340                       | 60,884                   | 19,057  | 18,031       | 41,737                       |
| 1969       | 26,992       | 102,502           | 18,473                       | 68,121                   | 19,639  | 17,836       | 45,607                       |
| 1970       | 25,438       | 102,422           | 19,102                       | 69,508                   | 21,209  | 16,066       | 44,455                       |
| 1971       | 24,999       | 109,269           | 16,442                       | 71,140                   | 20,745  | 17,572       | 47,208                       |
| 1972       | 27,054       | 119,408           | 16,350                       | 76,812                   | 25,563  | 21,698       | 50,870                       |
| 1973       | 28,789       | 124,681           | 18,361                       | 35,080                   | 28,852  | 23,452       | 56,838                       |
| 1974       | 36,040       | 152,555           | 27,221                       | 96,705                   | X       | 26,415       | 64,826                       |

Source: Statistics Canada, Fruit and Vegetable Processing Industries, Cat. No. 32—218.

X—Denotes data not available.

**TABLE 7. LOCATION OF CANADA'S FRUIT AND VEGETABLE PROCESSING PLANTS**

| Region or Province                | No. of Establishments |           |                          |
|-----------------------------------|-----------------------|-----------|--------------------------|
|                                   | Canning               | Freezing  | Dehydrating<br>or Frying |
| Vancouver &<br>Fraser Valley Area | 15                    | 19        | 0                        |
| British Columbia<br>Okanagan Area | 7                     | 2         | 0                        |
| Alberta                           | 3                     | 3         | 2                        |
| Manitoba                          | 2                     | 0         | 2                        |
| Ontario — Essex and Kent          | 29                    | 6         | 0                        |
| Ontario — London                  | 2                     | 2         | 0                        |
| Ontario — Hamilton                | 16                    | 8         | 0                        |
| Ontario — Niagara                 | 14                    | 2         | 0                        |
| Ontario — Toronto                 | 28                    | 9         | 2                        |
| Ontario — Georgian Bay            | 1                     | 1         | 2                        |
| Ontario — Belleville              | 17                    | 6         | 0                        |
| Quebec — Quebec City Area         | 6                     | 10        | 0                        |
| Quebec — Montreal                 | 58                    | 2         | 1                        |
| New Brunswick                     | 1                     | 3         | 2                        |
| Nova Scotia                       | 7                     | 7         | 2                        |
| Prince Edward Island              | 3                     | 3         | 0                        |
| <b>CANADA</b>                     | <b>209</b>            | <b>83</b> | <b>13</b>                |

Source: Survey of Fruit and Vegetable Processors, Economics Branch, Agriculture Canada, Summer 1974.

The United States and Mexico are our biggest source of fruit imports. Central America, South America, the United Kingdom, South Africa and Australia are also important sources. The United States provides most of our vegetable imports with important contributions from the United Kingdom, Europe, Taiwan, South Korea and the People's Republic of China. Processors import for resale in periods when domestic supplies are insufficient to meet demand or when the product, not produced in Canada, is needed to make a complete line.

An important factor affecting imports in recent years has been rapidly increasing production costs. Labor and land costs in Canada have moved well ahead of those in the United States and Mexico and other production inputs are also more costly.

## OWNERSHIP, MARKETING AND ENTRY PATTERNS

Most fruit and vegetable processing firms are Canadian-owned and have similar organization structures. Thirty-two of the survey respondents were private corporations, five were subsidiaries, four public corporations, two individual proprietorships, one a cooperative and one a crown corporation. A complete survey would have indicated a greater number of cooperatives.

**TABLE 8. RAW AND SEMI-PROCESSED PRODUCT PROCUREMENT**

| Commodity        | Source of Domestic Supply |          |               |             |         |
|------------------|---------------------------|----------|---------------|-------------|---------|
|                  | Domestic                  | Contract | Company Grown | Open Market | Foreign |
|                  | — No. of Plants —         |          |               |             |         |
| Asparagus        | 7                         | 5        | 1             | 1           | 5       |
| Beans            | 20                        | 14       | 5             | 2           | 1       |
| Beets            | 9                         | 8        | 3             | 2           | 1       |
| Broccoli         | 6                         | 6        | 3             | 1           | —       |
| Brussels sprouts | 5                         | 4        | 2             | 1           | —       |
| Cabbage          | 6                         | 4        | 2             | 3           | —       |
| Carrots          | 13                        | 14       | 3             | —           | —       |
| Cauliflower      | 12                        | 12       | 4             | 1           | 1       |
| Corn             | 15                        | 12       | 6             | —           | —       |
| Cucumbers        | 7                         | 7        | 1             | —           | 1       |
| Mushrooms        | 2                         | —        | —             | 2           | —       |
| Onions           | 6                         | 3        | 1             | 4           | 5       |
| Peppers          | 4                         | 2        | —             | 2           | 1       |
| Peas             | 23                        | 21       | 8             | —           | —       |
| Potatoes         | 11                        | 7        | 3             | 8           | —       |
| Tomatoes         | 15                        | 13       | 3             | 3           | 3       |
| Spinach          | 1                         | 1        | —             | —           | —       |
| Squash           | 1                         | 1        | —             | —           | —       |
| Apples           | 11                        | 7        | 2             | 4           | 2       |
| Apricots         | 9                         | 6        | —             | 2           | 6       |
| Blueberries      | 13                        | 6        | 3             | 6           | 1       |
| Cherries         | 13                        | 9        | —             | 4           | 2       |
| Peaches          | 14                        | 9        | 1             | 4           | 4       |
| Pears            | 12                        | 9        | 3             | 3           | 4       |
| Plums            | 9                         | 6        | —             | 2           | 1       |
| Prunes           | 5                         | 4        | —             | 1           | 2       |
| Raspberries      | 9                         | 6        | 3             | 4           | 4       |
| Strawberries     | 13                        | 8        | 2             | 5           | 11      |

Source: Survey of Fruit and Vegetable Processors, Economics Branch, Agriculture Canada, Summer 1974.

**TABLE 9. IMPORTS OF MAJOR FRUIT AND VEGETABLE PRODUCTS**

| Year | Vegetables <sup>a</sup> | Fruits <sup>b</sup> |
|------|-------------------------|---------------------|
|      | — '000 lb —             | — '000 lb —         |
| 1970 | 116,384                 | 97,443              |
| 1971 | 116,214                 | 105,271             |
| 1972 | 141,148                 | 106,093             |
| 1973 | 116,340                 | 120,192             |
| 1974 | 214,164                 | 109,685             |
| 1975 | 180,966                 | 107,571             |
| 1976 | 202,187                 | 113,836             |

<sup>a</sup>Preserved vegetables, asparagus, baked beans, beans, carrots, corn, mushrooms, tomatoes, tomato paste, cucumbers, pickles and relishes.

<sup>b</sup>Apples, apricots, peaches, pears, cherries in liquid, fruits in liquid and preserved fruits.

Source: Statistics Canada Cat. No. 65—303, Imports 1971-73  
Statistics Canada, Imports by Commodity, Cat. No. 65—007, December 1970 and December 1974.

**TABLE 10. FIRMS ENTERING CANNING AND FREEZING OF FRUIT AND VEGETABLES**

|         | Canning | Freezing | Total |
|---------|---------|----------|-------|
| 1900-19 | 6       | 0        | 6     |
| 1920-29 | 5       | 0        | 5     |
| 1930-39 | 4       | 2        | 6     |
| 1940-49 | 6       | 2        | 8     |
| 1950-59 | 5       | 4        | 9     |
| 1960-69 | 2       | 8        | 10    |
| 1970-74 | 6       | 0        | 6     |

Source: Survey of Fruit and Vegetable Processors, Economics Branch, Agriculture Canada, Summer 1974.

Most firms market through wholesale operations or retail outlets with little distinction made between wholesale and retail. Some also use brokers and direct sales. Sales to other processors and to the food service industry are infrequent.

From 1900 to 1970 the number of new canning operations, measured in 10-year intervals, has been relatively constant (Table 10). An exception was 1960-69 when an unusually large number of freezing operations started. Freezing firms, which began appearing in the thirties, increased their number significantly in 1960-69 but there has been no growth since.

Although not all newcomers to the industry are known, this pattern implies a degree of uniformity within the total canning and freezing sector. When interest in canning declined, interest in freezing operations increased. This suggests that returns were sufficient to encourage new entrants into the canning and freezing sector. But as no record of firms leaving the sector is available, no net gain or loss is recorded. The results we do have suggest that the industry has a mix of new and old facilities, that entry conditions are not changing and that processing fruit and vegetables is still an attractive investment for a limited number of new firms.

## PRODUCT IDENTIFICATION AND GRADE

Processing firms may use their own firm labels, private labels, other processors' labels or sell bulk. Many firms market some product under each identification. Private labels belong to major chain stores which contract directly with processing firms for the use of private or in-store labels. Several firms have well-established national labels and others have well-known regional brands. Many firms sell some products under all three types of labels.

Fruit and vegetable processors pack three qualities of product: fancy, choice and standard (and occasionally

sub-standard). Choice is packed slightly more often than fancy and standard less than both. Most companies use a separate label for each quality, helping consumers to differentiate among them.

## OPERATION PEAK

Although individual plants reach their peak operations at different times of the year, two months predominate. Of 49 plants surveyed, 19 are at peak operation during August and 19 in September. Other peak months are April, May, June, July, October and November. Although all of these plants operate on a 12-month basis, some others do not. But these are decreasing and are usually one or two-product plants. The plants operating on a full-year basis have included the processing of prepared foods and various food mixtures to remain in operation. The product range demands a flexible plant with specialized machinery. This causes high overhead costs per unit compared with costs in one or two-product plants. Consequently, with a greater proportion of the U.S. fruit and vegetable processing industry composed of one or two-product plants, U.S. processed products have a cost advantage over the multi-product Canadian fruit and vegetable processing industry.

Only eight of 38 firms reporting on other business activities were not involved in any activity besides processing fruit and vegetables. Sixteen firms were farming to provide raw products, while others were blending and manufacturing fertilizer, raising poultry, selling and repairing farm machinery and selling farm supplies.

In non-agricultural areas 10 firms were involved in trucking, five in marketing fresh fruits, vegetables and farm supplies and five in processing other foods such as meat, cheese, sauces, salad dressings and sandwich spreads. Other activities included can manufacturing, small machinery manufacturing, blending and re-packing tea and coffee and preparing puddings, jelly powders and a wide range of synthetic products. Renting land for fruit and vegetable production and renting cold storage space to other processors were also noted.

## POLLUTION ABATEMENT

As many fruit and vegetable processing operations are located in major population areas, they have been required to conform to recent pollution regulations. As these adjustments increase overhead costs but do not usually improve efficiency, costs per unit produced have increased. If all firms were confronted with the same regulations and costs, their competitive positions would

not be altered. Some firms, however, are located in more densely populated areas or have facilities which have required more renovation than others to meet pollution standards. The results are expected to change the competitive position with other domestic firms and imported products as well as close some facilities. To determine the impact of meeting pollution regulations, firms were asked whether expenditures had been or would likely be made, and the consequent economic effects. Of the 41 firms responding, 30 had already made some expenditure or anticipated some expenditure in the near future. Twenty-six had already made some type of expenditure. Seven of these anticipated no further expenditures while two others were uncertain. Specifically, one firm anticipates the voluntary installation of a chlorine dispenser in one plant, another is setting up a secondary treatment plant and still others are working with city authorities to curb pollution.

All firms were asked the monetary cost of meeting pollution standards. A small number gave estimated expected costs and costs to date, ranging from \$6,000 to \$4.6 million.

The regional impact of pollution regulations is dependent on population concentration. Ontario, British Columbia and several Maritime locations experience the greatest impact, especially around major cities and areas with limited land and water.

Compliance with pollution regulations by Canadian fruit and vegetable processors may affect competition with imports from countries where similar regulations do not exist. If the additional costs per unit processed were available, some specific compensation might be made. Without exact data, however, the costs can only be estimated. Thus in determining if Canadian products are competitive with imports, the survey suggests that the added costs of meeting domestic pollution regulations be taken into account.

## INDUSTRY OUTLOOK

Technological and marketing advances have brought several changes to the food processing industry: larger processing plants, fewer firms, a broader range of products and improved product quality. Recently there has been an increased frequency of periodic importations of low-priced products. This could bring changes to, if not threaten the existence of parts of the industry.

Historically, enterprising exporters and importers have used surplus and deficit supply conditions to move

products from low to high-priced markets. In these situations, the local or domestic producers, while protesting the effect of low-priced imports on their markets, received very little attention, and perhaps rightly so. These situations did occur infrequently and were reversed now and then when domestic producers benefited as often as foreign exporters.

Several changes in market structure and technology may have altered the situation. In today's modern market improved transportation allows any country to take advantage of strong market situations by quickly moving product to another country. In Canada several chain store companies sell most of the groceries whereas many independent stores were involved a few years ago. These companies are not dependent on domestic suppliers to guarantee a year-round supply and have an effective distribution system. In addition, improved communication quickly reveals ideal market situations to potential suppliers. Consequently domestic producers have short periods when their markets are strong.

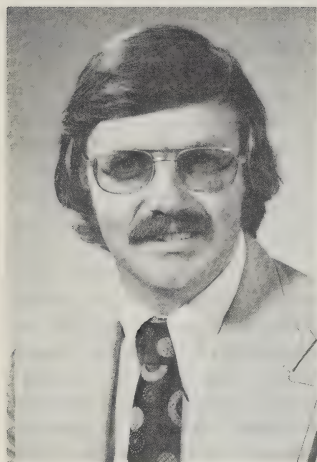
In recent years some eastern countries in seeking foreign exchange have compounded the problem by establishing a price level below that of competition and unrelated to production costs. Other countries may have a legitimate surplus situation and rapidly move product into a stronger market. What has changed is that low-priced imports are more readily available while the strong markets which historically offset these poor ones are less frequent and of short duration. Low-priced imports are not completely dependable and domestic production is still relied upon during shortages of world supplies.

Under the new market conditions it may be necessary to guarantee the domestic industry a percentage of the domestic market or establish a minimum price level. A program that assures equal access to all other countries wishing to sell to Canada while protecting the domestic industry should be possible. Such a program could concentrate on increasing efficiency and assuring a proper allocation of resources. To replace the present specific duty tariff structure currently under review by the Tariff Board<sup>5</sup>, the program could, for example, introduce an ad valorem tariff system to assist in offsetting inflation. Without such a program, segments of the fruit and vegetable processing industry may disappear.

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<sup>5</sup>Based on Part I of the Tariff Board report No. 152 on fruit and vegetables.

# RESOURCE FLOWS TO AGRICULTURE IN DEVELOPING COUNTRIES



N.E. Norcott\*

*The ultimate solution to the problem of food shortages in developing countries lies in increased production in these countries. To arrive at this solution, there must be increased investment in their agriculture from both internal and external sources. Agriculture is receiving high priority in Canada's development assistance strategy.*

## INTRODUCTION

If a significant improvement in the world food situation is to be made, there must be a substantial and sustained increase in food production in the foreseeable future. In order to meet present and future world demand for food and to provide for an adequate level of world food security, increased production, especially in developing countries, is essential.

The International Development Strategy for the Second United Nations Development Decade (1970-80) calls for a minimum annual agricultural production growth in developing countries of four percent. Growth, however, has failed to reach four percent and production is not projected to match demand by 1985 (Table 1). The rate of growth has, of course, varied from country to country. In several countries the target has been exceeded and in many others food output has grown faster than food demand. However, the overall growth rate has not been high enough, resulting in the need for greater and greater levels of food imports and its consequent burden of payment.

The following areas, among others, require particular attention in order to solve the problem: adequate supplies of essential inputs such as fertilizers, pesticides, quality seed and water; sufficient incentives to farmers; development of rural infrastructure including storage, processing, transportation and marketing systems; improvement and conservation of cultivated and cultivable land; research, training and extension; progressive social and structural transformation of agriculture. Meeting any of these objectives will require increased investment in the agricultural sector of developing countries.

The purpose of this article is to examine resource flows to agriculture in these countries. A broad definition of agriculture is used. This covers activities that contribute directly to the development of agricultural production as well as those that contribute indirectly such as development of rural infrastructure and agricultural industries. In keeping with international practice, fisheries and forestry are also included.

## INVESTMENT REQUIREMENTS FOR AGRICULTURAL DEVELOPMENT IN DEVELOPING COUNTRIES

The only comprehensive estimates of specific investment requirements have been prepared by the Food and

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TABLE 1. WORLD FOOD PRODUCTION AND DEMAND

|                                   | Average Annual<br>Production Increases |         | Projected Annual<br>Production and<br>Demand to 1985 |        |
|-----------------------------------|--|---------|--|--------|
|                                   | 1961-70                                | 1971-75 | Production   | Demand |
|                                   | — percent —                            |         |  |        |
| World                             | 2.8                                    | 2.2     | 2.7  | 2.4    |
| Developed Market Countries        | 2.5                                    | 1.8     | 2.8  | 1.5    |
| Eastern Europe and U.S.S.R.       | 3.2                                    | 2.1     | 3.5  | 1.7    |
| Developing Market Economies       | 2.9                                    | 2.5     | 2.6  | 3.6    |
| Africa                            | 2.9                                    | 0.5     | 2.5  | 3.8    |
| Far East                          | 2.7                                    | 2.8     | 2.4  | 3.4    |
| Latin America                     | 3.0                                    | 2.7     | 2.9  | 3.6    |
| Near East                         | 3.3                                    | 3.7     | 3.1  | 4.0    |
| Asian Centrally-Planned Economies | 2.8                                    | 2.4     | 2.6  | 3.1    |

Source: FAO and World Food Conference Secretariat.

Agriculture Organization (FAO) of the United Nations. Using revisions of figures originally prepared in 1969, the World Food Conference Secretariat estimated in 1974 that \$120 billion (in 1972 prices) would be needed in developing countries for the 1975-85 period to carry out necessary action in the areas of fertilizers and other inputs, livestock and fisheries, land and water resources development, and research and technology. On the basis of this estimate, the total annual investment required would have to increase from the 1972 level of \$8-10 billion to \$16-18 billion during 1975-80. Of this amount, one third would have to come from external sources, which would require outside investment to increase from \$1.5 billion per year in 1972 to \$5-6 billion per year for the 1975-80 period (at 1972 prices). These resources, it was suggested, would be required for the following purposes [1]:

- (a) \$2.5 billion for land and water development;
- (b) \$1.2 billion for credit, storage and marketing;
- (c) \$1.0 billion for the development of crop and livestock production;
- (d) \$0.6 billion for research.

At 1975 prices, the range of required external resources increases to \$7-\$9 billion.

While global figures give an indication of the magnitude of resources required, it is only at the individual-country level that a picture of actual needs can be seen. But, very little is known about individual-country requirements. One of the reasons is the absence of a clear picture of a country's food situation and its ability to deal with it. Insufficient information is available thus far on the reasons for slow production growth in individual countries or the resources needed by these countries to increase production. Without this data it becomes

difficult to analyze a country's internal and external investment requirements. In an attempt to deal with this problem, the Consultative Group of Food Production and Investment in Developing Countries (CGFPI — a jointly-sponsored World Bank, UNDP, and FAO body) recently began to work with selected developing countries to prepare national food plans. The aim of these food plans is to assist countries to identify, in both qualitative and quantitative terms, their food problems so that appropriate measures can be undertaken to deal with them. Once the situation in a country is known, a realistic plan to deal with its food problems can be prepared, including a determination of the level of investment required. Thus far India, Sudan and Bangladesh and Honduras have agreed to work with the CGFPI to develop national food plans.

While there is a scarcity of information on the investment needs of individual developing countries, there have been serious efforts to try to identify countries with the most serious food problems. Using studies and analyses carried out by FAO, the World Bank, CGFPI and the International Food Policy Research Institute, the Secretariat of the World Food Council has compiled a preliminary list of 43 "food priority countries" [2]. Eleven of the countries are in Asia, including India, Pakistan, Bangladesh and Sri Lanka. Twenty-four are in Africa and include all the countries in the Sahel region (Chad, Niger, Upper Volta, Mauritania, Mali and Senegal). The remaining countries are in Latin America and the Middle East. The World Food Council, at its second session in June 1976, called on relevant international and regional agencies and institutions to work with food priority countries in the determination and implementation of specific measures and programs to accelerate food production and identify financial resource requirements.

## Flow of Resources

External assistance to agriculture in developing countries comes basically from four sources: bilateral sources from OECD countries; multilateral agencies; OPEC countries, and socialist countries. Table 2 shows commitments for the 1973-75 period. These figures include capital and technical co-operation assistance (e.g., agricultural experts, fellowships, training, etc.) and assistance provided in grants and concessional loans. The figures show that official development assistance rose 72 percent in 1974 over 1973 and 41 percent in 1975 over 1974. At constant 1973 prices the increases are estimated by FAO to be 22 percent in 1974 and 25 percent in 1975. The 1975 increases were mainly related to large commitments by multilateral agencies, particularly the World Bank, and by OPEC countries. Commitments by OECD/DAC<sup>1</sup> countries, on the other hand, decreased almost \$500 million in 1975 after a significant increase in 1974. In terms of total OECD/DAC assistance, the agricultural portion was reduced from 20 percent in 1974 to 12 percent in 1975. The major OECD/DAC contributors are the United States, France, Canada and Germany. In 1975 the United States committed \$421 million for agricultural development, or 11.2 percent of its total aid commitments. France committed \$166 million (seven percent of total commitments) and Germany committed \$119 million (7.5 percent of total commitments) for this purpose [3]. Canada's assistance programs in agriculture are discussed in a later section.

Multilaterally, the largest single external source of funds for direct agricultural investment is the World Bank Group [4]. Loans for agriculture from the Bank and interest-free credits from the International Development Association for the fiscal year July, 1974 – June, 1975 were \$1.9 billion, almost double the levels of the previous two years. In fiscal 1976, credits dropped to \$1.6 billion. The other major multilateral sources are the regional development banks [4]. Asian Development Bank loans to agriculture in 1975 were \$246 million, 37 percent of its total loans. The Inter-American Development Bank lending to agriculture in 1975 was \$332 million, about 24 percent of all its loans. African Development Bank loans were \$45 million, 23 percent of its total loans. The other major multilateral source is the United Nations Development Program (UNDP); in 1975 about \$60 million or 19 percent of its total commitments were for agriculture [5].

**TABLE 2. COMMITMENTS OF OFFICIAL DEVELOPMENT AID TO AGRICULTURE 1973-75<sup>a</sup>**

|                                    | 1973         | 1974         | 1975 <sup>b</sup> |
|------------------------------------|--------------|--------------|-------------------|
| — million dollars (U.S.) —         |              |              |                   |
| DAC bilateral sources              | 803          | 1,648        | 1,155             |
| Multilateral agencies <sup>c</sup> | 1,243        | 1,919        | 3,250             |
| OPEC countries                     | 44           | 200          | 931               |
| Socialist countries <sup>d</sup>   | 185          | 159          | 200               |
| Other <sup>e</sup>                 | 20           | 25           | 30                |
| <b>Total</b>                       | <b>2,295</b> | <b>3,951</b> | <b>5,566</b>      |

<sup>a</sup> Including official development assistance (ODA) by OECD/DAC countries and concessional credits and loans from multilateral agencies.

<sup>b</sup> Preliminary.

<sup>c</sup> IBRD, IDA, IDB, AsDB, AfDB, UNDP and EEC.

<sup>d</sup> Assumed as 11 percent of total economic aid commitments to developing countries.

<sup>e</sup> Technical co-operation among developing countries not covered elsewhere, based on rough estimates.

Source: OECD/DAC Secretariat and FAO estimates.

IBRD: International Bank for Reconstruction and Development (World Bank)

IDA: International Development Association

IDB: Inter-American Development Bank

AsDB: Asian Development Bank

AfDB: African Development Bank

UNDP: United Nations Development Program

EEC: European Economic Community.

The most dramatic increase in assistance to agriculture in recent years has come from OPEC countries, the value rising from \$44 million in 1973 to over \$930 million in 1975. Saudi Arabia contributed about 40 percent, with Kuwait and Iran supplying about 23 percent each [5].

## Distribution of Assistance

Table 3 shows the regional distribution of capital and technical assistance for the period 1973-74. On a per capita basis, the African region was the largest recipient at about \$2.50 per year. Latin America and the Near East followed at about \$2. Asia and the Far East, however, with slightly more than 50 percent of the population of the developing world, received slightly more than \$1. On a per capita GNP basis, countries with a per capita income of less than \$200 (60 percent of the population of developing countries) received about 90 cents per year in agricultural commitments per head of population [5]. Countries with a per capita GNP of more than \$400 (24 percent of the population) received about \$2.

Analysis by FAO of capital aid commitments for 1973 and 1974 (over 85 percent of total OECD/DAC and multilateral aid commitments) reveals that within each region assistance tends to be concentrated in a few

<sup>1</sup> Organization for Economic Co-operation and Development, Development Assistance Committee.

**TABLE 3. DEVELOPMENT ASSISTANCE COMMITMENTS FOR AGRICULTURE (Annual Average 1973-74)**

| Developing Regions | Mid-1973 Population | Total Capital and Technical Assistance |                           |
|--------------------|---------------------|--|---------------------------|
|                    | — percent —         | — percent —                            | Per capita<br>— dollars — |
| Africa             | 15.0                | 24.1                                   | 2.53                      |
| Asia & Far East    | 53.1                | 37.7                                   | 1.12                      |
| Europe             | 5.4                 | 4.8                                    | 1.39                      |
| Latin America      | 15.5                | 19.9                                   | 2.03                      |
| Near East          | 11.0                | 13.5                                   | 1.91                      |
| Total              | 100.0               | 100.0                                  | 1.57                      |

Source: CGFPI estimates using material provided by OFCD.

countries [6]. In the Far East 74 percent went to India, Indonesia, Malaysia, Bangladesh and Pakistan. In the Near East over 50 percent went to Egypt, Syria, Sudan and Morocco. In Latin America, Mexico received 43 percent. Thirty-eight percent of capital assistance directed to Africa went to three countries — Tanzania, Kenya and Ethiopia. Overall, 11 countries (India, Indonesia, Mexico, Bangladesh, Brazil, Sudan, Ethiopia, Ecuador, Pakistan, Tanzania and the Philippines) received over 50 percent of capital assistance commitments during this period.

Table 4 shows the allocation of capital development assistance by activity for 1973-74. Land and water development received the greatest allocation. The next most important single activity was the establishment of

**TABLE 4. OBJECTIVES OF TOTAL DEVELOPMENT ASSISTANCE CAPITAL COMMITMENTS FOR AGRICULTURE**

| Annual Average 1973-74  |             |
|---|-------------|
| Activity  | — percent — |
| Land and Water Development  | 30          |
| Agricultural Development<br>(e.g. rural development;<br>agricultural credit; marketing,<br>co-operatives, etc.) | 21          |
| Agricultural Industries<br>(Fertilizer Industry 11 percent)   | 19          |
| Crop Development  | 12          |
| Livestock and Dairy Development,<br>Animal Disease  | 10          |
| Fisheries   | 3           |
| Forestry  | 2           |
| Miscellaneous   | 3           |

Source: CGFPI.

fertilizer plants, mainly in the Far East and the Near East.

The allocation of resources by activity varies from region to region [5]. In the Near East, for example, allocations for irrigation and drainage, and flood control amounted to over 50 percent of total allocations in 1973-74. Development of the fertilizer industry was next, receiving approximately 19 percent. In Latin America, irrigation, flood control and land-settlement projects received over 30 percent of resources, with general agricultural development, rural development, and livestock development and animal health receiving approximately 12 percent each. In the African region crop development received the greatest share of total resources. In Asia and the Far East, irrigation, drainage and flood control activities and development of agricultural industries, particularly fertilizers, received the greatest percentage of resources.

## CANADA'S AGRICULTURAL DEVELOPMENT ASSISTANCE <sup>2</sup>

In keeping with the strategy of focusing its development assistance on the most critical problems facing developing countries, the Canadian Government has, in recent years, through its official aid agency, the Canadian International Development Agency (CIDA), assigned a higher priority to agricultural production and rural development.

Assistance is provided through CIDA's bilateral and multilateral programs with the overall objectives being to increase national food production, and improve national nutritional levels.

### Bilateral Program

No other sector in CIDA's bilateral program has experienced as large a growth in recent years as has agriculture. In fiscal year 1973-4 approximately six percent of total bilateral funds were allocated for agricultural development projects. In 1975-76 this increased to 14 percent, or about \$65 million. Initial projections for the 1977-82 period are that 33 percent of total commitments may be directed to agriculture, making it the highest-priority sector.

In carrying out this increased agricultural program, CIDA faces a number of possible constraints. A major

<sup>2</sup>The author thanks Mr. T.G. Willis of the International Liaison Service, Agriculture Canada, for his assistance in the preparation of this section.

one is the shortage of skilled Canadian technical agricultural personnel available for work in developing countries. This may result in the shortage of a good selection of well-formulated agricultural development projects. Canada's capital-intensive agricultural production methods, in many cases, are not applicable to the needs of developing countries. Also Canada's technical competence for crops and procedures is peculiar to temperate regions. Notwithstanding the difficulties, it is felt that Canada has relevant expertise to offer in the following areas, among others: dryland farming, cereal breeding, bulk storage and handling of cereals, agricultural co-operatives and credit, extension education, economic analysis and planning, plant protection, animal health, range management and forage crop improvement, animal nutrition, processing of agricultural products, soils surveys and land-use capability [7].

CIDA's Bilateral Programs Branch is responsible for the development and management of agricultural projects. It receives advice and assistance from the agriculture, fisheries and forestry experts working in the Special Advisers Branch. The actual implementation of projects in many cases is done by outside executing agents, both private and public. The Canada Department of Agriculture has been the executing agent for several projects including the internationally-recognized drylands agriculture project in Hyderabad, India and the agronomic research project in Tanzania. Provincial departments of agriculture and universities are also tapped. The Saskatchewan Department of Agriculture, for example, is executing a rangewater development project in Kenya. The University of Guelph is helping to establish a faculty of veterinary medicine at the University of Malaysia. Private agricultural consultants are also employed.

Table 5 contains a provisional list of CIDA projects in progress or planned in the agricultural sector as of July 1, 1976. Activities are presently centered on forestry, animal production, crop storage (especially cereals) and agricultural services projects. Because of the difficulty in using Canadian agricultural techniques in developing countries, crop production projects tend to be small in number. Geographically, the Asian, Caribbean and Latin American regions contain almost an equal number of projects followed by Francophone Africa and Commonwealth Africa. Predominant agricultural sector projects tend to differ according to region. In Asia, for example, CIDA's activities centre on crop storage and forestry. In Commonwealth Africa and the Caribbean, animal production projects are the most numerous.

Agriculture's share of total bilateral assistance is projected to increase significantly for some regions in the 1977-82 period. Over 40 percent of the resources, for example, for the Commonwealth Africa and Latin America regions may be allocated for agricultural development. Resources for agricultural development in the Caribbean are projected to more than double from present levels to about 26 percent of total allocations.

### Multilateral Programs

Canada supports several international and regional institutions involved in agricultural development.

In 1975-76 approximately \$148 million was provided to the five major financial lending institutions: the World Bank Group, the Asian, African, Inter-American and Caribbean Development Banks. Some of these funds were used by the banks for agricultural development projects [8].

**TABLE 5. SECTORAL COMPOSITION OF CIDA AGRICULTURAL PROJECTS BY REGIONS**

| Sectors               | Asia |    | Caribbean |    | Latin America |    | Francophone Africa |    | Commonwealth Africa |    | Total |     |
|-----------------------|------|----|-----------|----|---------------|----|--------------------|----|---------------------|----|-------|-----|
|                       | A    | B  | A         | B  | A             | B  | A                  | B  | A                   | B  | A     | B   |
| Crop production       | 1    | —  | 1         | —  | 2             | 1  | 3                  | 1  | —                   | 1  | 7     | 3   |
| Crop prod. (storage)  | 9    | 9  | 4         | 5  | 4             | 5  | 7                  | 4  | 4                   | 7  | 28    | 30  |
| Animal production     | 3    | 5  | 10        | 10 | —             | 4  | 2                  | 4  | 10                  | 10 | 25    | 33  |
| Irrigation & drainage | 4    | 2  | —         | 1  | 2             | 3  | 4                  | —  | 2                   | 2  | 12    | 8   |
| Agricultural input    | 2    | 2  | —         | 3  | 2             | 1  | —                  | —  | —                   | —  | 4     | 6   |
| Agricultural services | 3    | 5  | 5         | 7  | 6             | 10 | 2                  | 1  | 2                   | 2  | 18    | 25  |
| Fisheries             | 4    | 1  | 5         | —  | 4             | 2  | 6                  | 4  | —                   | —  | 19    | 7   |
| Forestry              | 13   | 6  | 5         | 9  | 11            | 10 | 10                 | 8  | 3                   | 5  | 42    | 38  |
| Total                 | 39   | 30 | 30        | 35 | 31            | 36 | 34                 | 22 | 21                  | 27 | 155   | 150 |

A: On-going projects on July 1, 1976

B: Projects in planning at the same date.

Source: Renewable Resources Division, CIDA.

Canada actively supports and participates in the work of several technical assistance agencies and policy institutions. The major agencies are the UNDP, the FAO, the International Fund for Agricultural Development (IFAD), the World Food Council, the Inter-American Institute of Agricultural Sciences and the CGFPI. In 1975-76 Canada contributed approximately \$24 million to the UNDP, a portion of which will be used to fund agricultural development projects [8]. Canada will contribute \$33 million to IFAD over a three-year period.

There are currently 11 international research centres whose work is co-ordinated by the Consultative Group on International Agricultural Research. The centres carry out research on agricultural products of particular importance to developing countries such as maize, wheat, rice and potatoes. In 1975-76 a total of \$5.78 million was contributed to support the work of the centres [8]. Canada also finances the International Development Research Centre. In 1975-76, \$27 million was provided, of which 46.4 percent was used for agriculture, food and nutrition sciences projects [9].

In addition to its bilateral and multilateral programs, CIDA provides funds on a matching grant basis to non-governmental agencies. In 1975-76 approximately \$32 million was contributed to various organizations and it is estimated that at least 25 percent of it was used for agricultural development projects [10].

## CONCLUSIONS

On the basis of available data, a few conclusions can be drawn. First, if projected demand figures are correct, increased investment in the agricultural sector in developing countries will be required in the next decade. To meet the demand, developing countries must be prepared to assign a high priority to agriculture in national development efforts which includes appropriate levels of investment. Even if this is done, external resource transfers will be required and will have an important role to play. In this connection the newly-created one billion dollar International Fund for Agricultural Development will be an important source of additional resources.

But if scarce external resources are to be utilized effectively, there must be a clearer indication of a country's particular agricultural investment needs. It is important therefore that a country's food problems be identified in order that local and external resources can be mobilized. Subsequently, well-formulated projects must be prepared. Bilateral donors and multilateral agencies have a role to play assisting developing countries in their efforts in this regard.

It would appear that the world food crisis of the early 1970s resulted in higher priority being given by bilateral donors and multilateral agencies to agricultural development. In Canada's case, even a greater percentage of bilateral funds in the near future will be directed at this need. However, in spite of the substantial increase in the volume of aid to agriculture in developing countries since 1973, the present level of \$5-\$6 billion is still below the \$7-\$9 billion figure (at 1974 prices) suggested by the World Food Conference as being necessary for the 1975-80 period in order to arrive at meaningful increases in production.

It does appear that those agricultural sectors requiring the greatest investment are in fact receiving the largest percentage of total allocations. The World Food Conference identified land and water development, credit, storage and marketing and crop and livestock production needs, in that order, as requiring the greatest levels of investment. Capital commitments, at least in 1973-74, were allocated to those sectors in almost the same order. It is hoped that bilateral and multilateral donors will continue to allocate significant portions of their resources in this direction and in particular that the decline in OECD/DAC assistance from 1974 levels will not continue.

As a final general conclusion, the poorer developing countries appear to receive a smaller proportion of external resources on a per capita basis than do the higher-income countries. There are many factors considered in the determination of the allocation of resources by sector and country. The Canadian strategy of concentrating assistance on those countries at the lower end of the development scale is worthy of support.

## REFERENCES

1. United Nations World Food Conference, Document E/CONF 65/4 — "The World Food Problem: Proposals for National and International Action".
2. United Nations World Food Council, Document WFC/20 — "Increasing Food Production in the Developing Countries", April 1976.
3. OECD, "Development Co-operation, Efforts and Policies of the Members of the Development Assistance Committee, 1976 Review" Report by the Chairman of the Development Assistance Committee, November 1976.

4. FAO, Document CL 70/2 – “The State of Food and Agriculture 1976”, October 1976.
5. Consultative Group on Food Production and Investment in Developing Countries, Document FPI/76/2-5 – “Further Analysis of Resource Flows in Agriculture”, July 1976.
6. Eighteenth Session of the FAO Conference – Document C 75/4 – “Review of Field Programmes 1974-75”, August 1975.
7. Canadian International Development Agency – “Sectoral Guidelines for Rural Development and Renewable Resources”, April 1976.
8. Canadian International Development Agency Annual Review 1975-6 – “Canada and Development Cooperation”, December 1976.
9. International Development Research Centre Annual Report 1975-1976, July 1976.
10. Information Division, Canadian International Development Agency.

## BOOK REVIEW

A report by the Economic Council of Canada entitled **LIVING TOGETHER: A Study of Regional Disparities**<sup>1</sup> reveals that regional disparities are large. Chapters 2, 3 and 4 are devoted to measuring these disparities, and to examining the objectives of regional policies. They focus on three primary goals: reducing the gaps between provinces in unemployment rates, population growth rates and standards of living. The Council gives its views on the appropriate priorities among the competing goals.

The Council examines causes of disparities and five chapters are devoted to analyzing income and unemployment gaps. Conclusions and recommendations are presented in Chapter 10. In general, the Council concludes that it is possible to improve the present situation while still respecting two principles that it deems fundamental. "One is that the proportion of Gross National Product passing through the hands of governments as a group should not increase." In other words, the Council has avoided making recommendations that would require an increase in taxes. "The other is that local efforts are better than help from outside." In the Council's view, there is considerable room for provincial government initiatives to reduce regional disparities.

The report concludes that "economic well-being is sharply affected by the region one happens to be born or brought up in."

On income disparities among regions it states, "equity among people rather than equity among regions should be the prime concern of policy-makers." Nevertheless "equity among people requires policy actions that are related to provinces or regions."

On population growth the Council concludes that only the regions of British Columbia and Ontario will see a growth in total population more rapidly than elsewhere. In all other regions it is said "unless there are considerable increases in participation rates or major advances in productivity, these regions will experience very weak economic growth."

In short, even though there is no general criterion for determining whether life is better in some parts of Canada than others, the disparities are real and the probability of being rich or poor and finding a job differs from one region to another.

The Council is optimistic about the prospects for improving the situation even though "the factors underlying regional disparities have turned out to be extraordinarily complex." In its view, the tendency to concentrate on the role of industrial structure, physical capital, endowment in natural resources and transportation in regional development, has caused other equally important factors to be neglected. In particular, the roles of human capital, the propensity to spend and technological gaps have been underemphasized. "A recognition of these rarely discussed causes of disparities leads us to believe," writes the Council, "that the arsenal of effective policy weapons could be broadened with little or no increase in taxes, and that there is scope for much more provincial action than at present."

The major cause of income disparities is the productivity gaps between regions. It was found that output per worker is a key factor in labor productivity and that it is affected by quality of labor, level of technology and level of education of workers. The Council also said that capital investment alone directed into manufacturing would not automatically improve the productivity of a region.

In addition to regional influences due to structure, output per worker, quality of labor and capital stock, productivity may be influenced by the level of technology, the effort devoted to research and development, the level of competence of management personnel, worker attitudes, the size of the city in which the firm is located, economies of scale and transportation costs.

People from the Prairies have long contended that the existing freight rate structure works against their economic development in favor of Central Canada. They maintain that it perpetuates an unfavorable industrial structure, by making it less efficient for them to manufacture and process their own raw materials than for Central Canada to do so. On the basis of preliminary research in this report on regional development, the Council supports this view, noting that "on balance, we think that a more economically efficient rate structure

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<sup>1</sup>This review is provided as a service to readers because of the importance of the subject. It is not necessarily the view of Agriculture Canada or the Government of Canada. Copies of the report are available from Printing and Publishing, Supply and Services Canada, Ottawa, K1A 0S9. Price: Canada \$5.50; other countries \$6.50.

would be conducive to an increased amount of manufacturing in the Prairies.” Accordingly, it indicates two kinds of changes in transport charges that might improve the situation.

The first concerns the substantially higher rates charged for goods moving from east to west as opposed to west to east. In 1973, it cost an average 0.8 cents per ton-mile to ship goods from the Prairies to Central Canada compared with 2.8 cents per ton-mile for goods moving in the reverse direction. It would make more economic sense to raise the rates for goods moving east and to lower them for goods moving west, and it would also promote secondary manufacturing in the Prairies. Since raw materials are relatively bulky to transport, higher freight charges could make it more efficient for the Prairies to process some of these goods themselves, rather than shipping them east for processing.

The Council sees a second source of inefficiency in the significant difference in the rates charged for raw materials and manufactured goods being shipped in the same direction. Average changes per ton-mile to ship manufactured goods from the Prairies to Central Canada are approximately double those of moving raw materials. It seems unlikely that there is this great a difference in the actual costs of transporting these goods. The Council believes that if the freight rate structure reflected actual

costs more accurately, there would be even more incentive to process raw materials in the Prairies rather than processing them elsewhere.

Although the Council has deferred formal recommendations on this subject pending further analysis, it believes that changes to promote secondary manufacturing in the Prairies would not only be beneficial from the Prairies’ perspective but would also prove economically efficient from a national point of view. Moreover, it notes that current rates of outmigration from Saskatchewan and Manitoba indicate that there is a sufficient supply of labor to support this expansion.

People from the Atlantic region have often contended that high transportation costs have aggravated the region’s unemployment and income problems by undermining its competitiveness. However, the Council’s research does not support this argument. It finds that the existing subsidies on rail and truck rates are sufficient to ensure that the Atlantic Provinces are not placed at an undue competitive disadvantage. Transport of most manufactured goods is subsidized at a rate of 50 percent on shipments out of the Atlantic region, while almost all other goods receive a 30-percent subsidy. Within the region, all transportation is subsidized at 15 percent. Consequently the Council believes that further transportation subsidies would not be appropriate.

# NOTES

## FARM REAL ESTATE VALUES IN ALBERTA

The average value of farmland in Alberta more than doubled between 1971 and 1976, rising from \$67 per acre to \$177. The average was \$145 in 1976. These facts are revealed in Alberta Agriculture's recent report "1976 Agricultural Real Estate Values in Alberta" and are based on data from farmland sales.

The report shows that almost 3 million acres, valued at about \$525 million, changed hands in 1976 compared with just over 3.1 million acres, valued at almost \$456 million, in 1975. The average value per acre could be over \$200 in 1977, according to the author, if appreciation rates of the past two years continue. However, a levelling-off experienced in late 1976 could continue through 1977, leaving the average value below \$200.

Copies of the report are available from the Agriculture Building, 9718 - 107 St., Edmonton, T5K 2C8.

## DEVELOPMENTS IN CROP INSURANCE

Agriculture Canada's Crop Insurance Division estimates that about 112,000 farmers applied for crop insurance for 1977-78, up about 16 percent from a year ago. About \$140 million in premiums was collected, compared with \$114 million last year. Federal contributions to the fund will also increase, to between \$60 and \$70 million, from \$56.5 million.

In Manitoba about 80 to 85 percent of the province's eligible farmers are covered for 1977-78, an increase of 15 percent. About 75 percent of Saskatchewan's producers have protection, an increase of 19 percent, while 55 to 60 percent of Alberta producers are covered.

National statistics for the past 16 years are shown in the accompanying table.

## CROP INSURANCE PARTICIPATION, 1960-76

| Year                 | No. of<br>Farmers | Coverage      | Total<br>Premium | Indemnities | Federal<br>Contribution <sup>a</sup> |
|----------------------|-------------------|---------------|------------------|-------------|--------------------------------------|
|                      |                   | — \$ —        | — \$ —           | — \$ —      | — \$ —                               |
| 1960-61              | 2,472             | 4,071,748     | 306,941          | 87,083      | 171,927                              |
| 1961-62              | 3,848             | 6,992,277     | 579,447          | 1,716,066   | 250,455                              |
| 1962-63              | 5,818             | 12,051,548    | 1,045,833        | 602,513     | 355,461                              |
| 1963-64              | 7,382             | 15,968,475    | 1,351,180        | 1,265,530   | 440,952                              |
| 1964-65              | 8,625             | 17,812,884    | 1,525,707        | 429,621     | 510,065                              |
| 1965-66              | 13,361            | 26,919,147    | 2,285,188        | 594,456     | 775,462                              |
| 1966-67              | 24,519            | 51,758,000    | 4,142,174        | 1,264,000   | 1,334,924                            |
| 1967-68              | 33,436            | 91,247,351    | 7,168,605        | 2,791,516   | 2,633,579                            |
| 1968-69              | 64,376            | 174,450,160   | 13,119,068       | 15,441,611  | 4,842,731                            |
| 1969-70              | 61,978            | 163,432,618   | 12,171,436       | 17,589,496  | 4,675,131                            |
| 1970-71              | 53,403            | 116,671,233   | 8,469,538        | 6,792,797   | 3,818,437                            |
| 1971-72              | 46,326            | 130,913,113   | 9,662,700        | 7,630,556   | 4,034,052                            |
| 1972-73              | 49,182            | 164,710,979   | 11,621,057       | 13,540,035  | 5,214,312                            |
| 1973-74              | 72,672            | 380,180,524   | 32,715,921       | 23,212,662  | 16,654,929                           |
| 1974-75              | 84,589            | 675,304,386   | 61,845,113       | 71,784,651  | 31,236,048                           |
| 1975-76              | 94,318            | 991,353,275   | 96,848,303       | 67,151,220  | 48,276,422                           |
| 1976-77 <sup>b</sup> | 96,132            | 1,182,054,741 | 113,701,417      | 63,878,144  | 56,456,505                           |

<sup>a</sup>includes contributions to administration and premium

<sup>b</sup>preliminary figures

## READERSHIP OF CANADIAN FARM ECONOMICS

Readers and authors may be interested in the following statistics showing who receives Canadian Farm Economics. Compiled by Economics Branch Publication Manager André Trempe, they indicate the periodical's distribution and the diversity of its readership.

Because of this diversity, we tailor individual articles to particular segments of the audience. For example, an article on beef cattle would likely be of direct interest only to beef farmers, extension workers and marketing firms. An article describing a computer program for use in farm management would be directed toward those

best able to adapt the program to practical use for farmers and extension workers. An explanation of technical or semi-technical procedures and systems might be of interest only to readers with specialized training.

On the other hand, we recognize that some topics will interest all readers. Examples are food prices, agricultural trade, changes in consumption patterns, energy and farm income.

Note: The statistics in the tables are for the English version only. The French version, *L'Economie agricole au Canada*, has a circulation of about 1,800. Over 80 percent of the recipients are in Quebec.

### CIRCULATION OF CANADIAN FARM ECONOMICS

| Location              | Number       |
|-----------------------|--------------|
| Northwest Territories | 4            |
| Newfoundland          | 34           |
| Prince Edward Island  | 78           |
| Nova Scotia           | 121          |
| New Brunswick         | 70           |
| Quebec                | 266          |
| Ontario               | 1,168        |
| Ottawa                | 490          |
| Manitoba              | 431          |
| Saskatchewan          | 580          |
| Alberta               | 705          |
| British Columbia      | 341          |
| United States         | 365          |
| Foreign Countries     | 439          |
| Bulk Copies           | 250          |
| <b>Total</b>          | <b>5,342</b> |

### CIRCULATION OF CANADIAN FARM ECONOMICS BY CATEGORY OF RECIPIENT\*

| Code         | Category                          | Number       | Percent      |
|--------------|-----------------------------------|--------------|--------------|
| 01           | Teaching institutions             | 630          | 14.7         |
| 02           | Public libraries                  | 167          | 3.9          |
| 03           | Provincial government offices     | 477          | 11.1         |
| 04           | Provincial libraries              | 48           | 1.1          |
| 05           | Federal government offices        | 569          | 13.3         |
| 06           | Federal government libraries      | 57           | 1.3          |
| 07           | Private individuals — farm        | 650          | 15.2         |
| 08           | Private individuals — non-farm    | 762          | 17.8         |
| 09           | Farm organizations & associations | 136          | 3.2          |
| 10           | Companies                         | 472          | 11.0         |
| 11           | Provincial extension workers      | 161          | 3.7          |
| 12           | Radio, T.V. and the press         | 129          | 3.0          |
| 13           | Embassies in Canada               | 30           | 0.7          |
| <b>Total</b> |                                   | <b>4,288</b> | <b>100.0</b> |

\*Excludes United States, foreign countries, bulk copies.

### CIRCULATION OF CANADIAN FARM ECONOMICS BY LOCATION AND CATEGORY

| Location     | Category and Circulation |     |     |    |     |    |     |     |     |     |     |     |    | Total        |
|--------------|--------------------------|-----|-----|----|-----|----|-----|-----|-----|-----|-----|-----|----|--------------|
|              | 01                       | 02  | 03  | 04 | 05  | 06 | 07  | 08  | 09  | 10  | 11  | 12  | 13 |              |
| NWT          | —                        | —   | 1   | 1  | —   | —  | —   | 2   | —   | —   | —   | —   | —  | 4            |
| Nfld.        | 1                        | —   | 19  | —  | 4   | —  | 1   | 5   | 2   | 1   | —   | 1   | —  | 34           |
| P.E.I.       | 10                       | 1   | 25  | —  | 11  | —  | 13  | 9   | —   | 6   | —   | 3   | —  | 78           |
| N.S.         | 25                       | 3   | 23  | 3  | 18  | —  | 13  | 18  | 1   | 7   | 9   | 1   | —  | 121          |
| N.B.         | 6                        | 3   | 27  | 3  | 13  | 1  | 3   | 8   | 1   | 4   | —   | 1   | —  | 70           |
| Quebec       | 47                       | 4   | 11  | 2  | 18  | 3  | 26  | 71  | 7   | 71  | 1   | 2   | 3  | 266          |
| Ont.         | 250                      | 83  | 81  | 13 | 39  | 6  | 206 | 197 | 31  | 189 | 27  | 45  | 1  | 1,168        |
| Ottawa       | 18                       | 1   | 3   | —  | 311 | 31 | —   | 56  | 2   | 32  | —   | 11  | 25 | 490          |
| Man.         | 50                       | 19  | 59  | 6  | 36  | 5  | 59  | 76  | 29  | 40  | 31  | 21  | —  | 431          |
| Sask.        | 58                       | 25  | 49  | 6  | 53  | 7  | 241 | 57  | 35  | 23  | 11  | 15  | —  | 580          |
| Alta.        | 114                      | 15  | 125 | 5  | 39  | 2  | 65  | 176 | 18  | 64  | 62  | 20  | —  | 705          |
| B.C.         | 51                       | 13  | 54  | 9  | 27  | 2  | 23  | 87  | 10  | 35  | 20  | 9   | 1  | 341          |
| Sub-total    | 630                      | 167 | 477 | 48 | 569 | 57 | 650 | 762 | 136 | 472 | 161 | 129 | 30 | 4,288        |
| U.S.         |                          |     |     |    |     |    |     |     |     |     |     |     |    | 365          |
| Foreign      |                          |     |     |    |     |    |     |     |     |     |     |     |    | 439          |
| Bulk         |                          |     |     |    |     |    |     |     |     |     |     |     |    | 250          |
| <b>Total</b> |                          |     |     |    |     |    |     |     |     |     |     |     |    | <b>5,342</b> |

# PUBLICATIONS

## ECONOMICS BRANCH

*Available from Publications Manager, Room 303, Sir John Carling Building, Ottawa, K1A 0C5.*

**Market Commentary, Animals and Animal Products.** June 1977. 39p. Tables and graphs. Contains situation and outlook for beef cattle and hogs for the second half of 1977. Also a short paper giving forecasts for 1978, using results from forecasting models. Complementing these is an article explaining the slaughter cattle and cow-calf stabilization programs in effect for 1977. Contributing authors are A.M. Boswell, G.E. Pugh, H.B. Huff, T.G. MacAulay and R.K. Eyvindson.

**Income Profile of Farm Taxfilers.** J.A. Gellner and G.J. Birks. 129 p. Bilingual. Mostly tables, with data for all provinces. Publication No. 77/9.

**Selected Agricultural Statistics for Canada.** J.R. Daviault. 149 p. Bilingual. Mostly tables giving wide variety of statistics on Canadian agriculture. Publication No. 77/10.

**Marketing Board Statistics, Canada 1975-76.** J.M. Sullivan. 25 p. Bilingual. Mostly tables. Summary of marketing board activities on a volume and dollar-value basis. Publication No. 77/12.

## OTHER PUBLICATIONS

**Report by the Tariff Board re Fresh and Processed Fruits and Vegetables.** Volume 1, Part 1. 1977. 320 p. Tables, charts and figures. Paper cover. Catalogue No. FT4-152/1-1. *Available from Printing and Publishing, Supply and Services Canada, Ottawa, K1A 0S9. Price: Canada, \$6.50; other countries, \$7.50.*

**CIDA, Highlights of the Past Five Years.** January 1977. 40 p. Bilingual. Paper cover. Figures, illustrations. *Available from Information Division, Communications Branch, CIDA, 122 Bank St., Ottawa, K1A 0G4.*

**Canadian Wheat Board Annual Report 1975-76.** 100 p. Paper cover. Charts, tables and figures. *Available from Canadian Wheat Board, 433 Main St., Winnipeg, Man., R3C 2P5. French also available.*

**The Mushroom Industry in Ontario.** Economics Branch, Ontario Ministry of Agriculture and Food. 50 p. April 1977. Tables, charts and photos. Paper cover. *Write: O.M.A.F., Legislative Buildings, Queen's Park, Toronto, M7A 1B6.*

**Summary of Ontario Farm Management and Accounting Project 1976.** University of Guelph and Ontario Ministry of Agriculture and Food. Contains costs and returns for various farm types in Ontario, based on CANFARM data. 25 p. Publication No. AEEE/77/4, June 1977. *Write: School of Agricultural Economics and Extension Education, University of Guelph, Guelph, Ontario.*

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## IN REPLY

*Note to Readers: We appreciate your letters and comments on Canadian Farm Economics. We encourage you to let us know your views.*

*If you think an issue or subject warrants an article, tell us and we'll try to accommodate you.*

*When forwarding an 'In Reply' page or a letter, indicate whether or not it is permissible to publish your comments in a subsequent issue. We would also like to know whether you are addressed as Miss, Ms., Mrs., Mr. or M.*

R.S. Butler, Professor, Western College of Veterinary Medicine, says he was particularly interested in T.C.

Gunn's February article on hog feeding enterprises in Nova Scotia. His comments are as follows: "I would be interested to know the actual veterinary expenses. They were lumped in with 'utilities and miscellaneous'. Similarly, it would have been valuable to have an estimate of the costs attributed to disease, e.g., mortality plus loss of feed efficiency, veterinary fees, drugs and vaccines, special management practices. Economists and veterinarians have been remiss in that we have failed to adequately inform producers of the extent to which animal diseases limit out livestock economy."

James L. Pavesi, a market research manager in Downers Grove, Illinois, found the beef and hog outlook in the

February issue useful. He welcomes "various viewpoints and informed outlooks," using the information in market research, sales and planning.

Gérard Bélair, an economist in Montreal, gave a high rating to the Hassan-Johnson article on the demand for food, in the April issue. He says that the information is very valuable for teaching, especially. S. Devereux, an agrologist in Fort Saskatchewan, also found the article useful, commenting in detail as follows: "I am concerned that in the article the authors have used some commodity groups with which consumers may not identify. Although there are several examples, the area of which I am most aware is that of 'beef and pork.' In research which I conducted in 1972 and published as a Master's thesis at U. of A. titled 'Consumer Attitudes Toward Meat,' I found strong evidence that consumers do not identify with commodities, but rather with individual cuts of meat. In the past, agricultural groups

and researchers have examined foods on a commodity basis because they are the terms in which the agricultural community deals, trades and produces food products. But consumers relate to what they buy at meat counters and often the validity of our research is less than optimum due to our fundamental wrong definition of a 'product'. While my concern may not be valid in areas such as 'beverages' or 'canned fruit', if we are interested in the most useful information relative to demand for meats, it appears that we could be badly misguided due to unavailability of data based on consumer concepts of products."

Garnet Norrish, extension specialist, University of Guelph, found the April article on integration useful for his work in livestock extension. He also liked the Quebec feed grain article and the stabilization back-grounder.



**IN REPLY TO AUTHORS AND EDITORS REGARDING AUGUST 1977**  
**CANADIAN FARM ECONOMICS**

I have read one or more of the following articles:

- (1) Instability in the World Beef Market
- (2) Canada's Fruit and Vegetable Processing Industry
- (3) Resource Flows to Agriculture in Developing Countries

1. My comments are on article number (1) (2) (3) (4)
2. On a scale of one to ten how useful was this article to you?
- not useful                      very useful.
- 1    2    3    4    5    6    7    8    9    10

3. Why?
4. How useful was the whole issue to you?
5. Do you have any suggestions or questions on the content of this issue?

How do you use this publication?

My comments may (    ) may not (    ) be used in a future issue of this publication. A copy of your comments will be forwarded to the author.

NAME (Please Print) ..... Occupation .....

ADDRESS .....

Please return the above to:

John McConnell, Managing Editor, Canadian Farm Economics,  
Information Division,  
Agriculture Canada, Sir John Carling Building,  
OTTAWA, Ontario,  
Canada,  
K1A 0C5




# CONVERSION FACTORS FOR METRIC SYSTEM

| Imperial units         | Approximate<br>conversion factor     | Results in:                          |
|------------------------|--------------------------------------|--------------------------------------|
| <b>LINEAR</b>          |                                      |                                      |
| inch                   | x 25                                 | millimetre (mm)                      |
| foot                   | x 30                                 | centimetre (cm)                      |
| yard                   | x 0.9                                | metre (m)                            |
| mile                   | x 1.6                                | kilometre (km)                       |
| <b>AREA</b>            |                                      |                                      |
| square inch            | x 6.5                                | square centimetre (cm <sup>2</sup> ) |
| square foot            | x 0.09                               | square metre (m <sup>2</sup> )       |
| acre                   | x 0.40                               | hectare (ha)                         |
| <b>VOLUME</b>          |                                      |                                      |
| cubic inch             | x 16                                 | cubic centimetre (cm <sup>3</sup> )  |
| cubic foot             | x 28                                 | cubic decimetre (dm <sup>3</sup> )   |
| cubic yard             | x 0.8                                | cubic metre (m <sup>3</sup> )        |
| fluid ounce            | x 28                                 | millilitre (ml)                      |
| pint                   | x 0.57                               | litre (ℓ)                            |
| quart                  | x 1.1                                | litre (ℓ)                            |
| gallon                 | x 4.5                                | litre (ℓ)                            |
| <b>WEIGHT</b>          |                                      |                                      |
| ounce                  | x 28                                 | gram (g)                             |
| pound                  | x 0.45                               | kilogram (kg)                        |
| short ton (2000 lb)    | x 0.9                                | tonne (t)                            |
| <b>TEMPERATURE</b>     |                                      |                                      |
| degrees Fahrenheit     | (° F-32) x 0.56<br>or (° F-32) x 5/9 | degrees Celsius (° C)                |
| <b>PRESSURE</b>        |                                      |                                      |
| pounds per square inch | x 6.9                                | kilopascal (kPa)                     |
| <b>POWER</b>           |                                      |                                      |
| horsepower             | x 746<br>x 0.75                      | watt (W)<br>kilowatt (kW)            |
| <b>SPEED</b>           |                                      |                                      |
| feet per second        | x 0.30                               | metres per second (m/s)              |
| miles per hour         | x 1.6                                | kilometres per hour (km/h)           |
| <b>AGRICULTURE</b>     |                                      |                                      |
| gallons per acre       | x 11.23                              | litres per hectare (ℓ/ha)            |
| quarts per acre        | x 2.8                                | litres per hectare (ℓ/ha)            |
| pints per acre         | x 1.4                                | litres per hectare (ℓ/ha)            |
| fluid ounces per acre  | x 70                                 | millilitres per hectare (ml/ha)      |
| tons per acre          | x 2.24                               | tonnes per hectare (t/ha)            |
| pounds per acre        | x 1.12                               | kilograms per hectare (kg/ha)        |
| ounces per acre        | x 70                                 | grams per hectare (g/ha)             |
| plants per acre        | x 2.47                               | plants per hectare (plants/ha)       |

CANADA DEPARTMENT OF AGRICULTURE  
OTTAWA, ONT.  
K1A 0C5

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VOLUME 12

NUMBER 5

OCTOBER 1977

# CANADIAN FARM ECONOMICS

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Agriculture  
Canada

HON. EUGENE WHELAN, MINISTER — GAÉTAN LUSSIER, DEPUTY MINISTER

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# THE CANFARM FARM RECORD SYSTEM



L. Bauer \*

*Information is the foundation of management. This is true for farmers as well as managers in the various facets of the agricultural industry. CANFARM'S purpose is to provide information<sup>1</sup> to farmers so that they can better manage their businesses and to researchers so that agricultural policy can remain in tune with changing conditions.*

## INTRODUCTION

The basis of information for farm management decisions is an effective accounting system. Accounting helps the farmer-manager know his financial strength and his potential for profit. It can help him anticipate problems and thus take steps to avoid them. It has long been recognized as an integral part of the management process<sup>2</sup>. In fact, at the turn of the century Warren used record keeping and group average comparisons as a basis for his early work in farm management [1]. Canada's provincial departments of agriculture, especially during the past 30 years, have expended considerable effort

designing farm account books and teaching farmers how to use them.

In the early 1960s a need was seen in Canada to eliminate duplication of effort and a start was made towards designing one system for the whole country [2]. Plaunt [3] summarized this philosophy in 1967 and in 1969 it began to take form as the early programs of CANFARM went into operation. Bringing together the differing ideas about designing and operating a Canada-wide farm accounting system was a mammoth task.

To overcome some of the initial growing pains, a new version of the CANFARM system went into operation on January 1, 1976. This project was initiated in March 1972 after an examination of the accounting needs of farmers and the kinds of information they used to provide to people they deal with. During 1975 over 800 farmers used the system on a test basis. The results were encouraging and in 1976 CANFARM began enrolling new farmers onto the system and converting those from its earlier version. By June 30, 1977 over 8,200 farmers were using the new system.

---

\*At time of writing, Dr. Len Bauer was Chief, Farm Records Section, CANFARM Service Agency, Guelph. He is now Associate Professor, Department of Rural Economy, University of Alberta, Edmonton. He was the project leader to build the CANFARM system described here, but thanks the project team for its work and farm management workers across Canada for their helpful suggestions along the way.

<sup>1</sup>The word 'information' is used here as distinct from the word 'data'. The distinction is that data are facts which must be organized and properly presented to become useful information.

<sup>2</sup>The management process is described by L.A. Bradford and G.L. Johnson, *Farm Management Analysis* (New York: John Wiley and Sons, Inc., 1953), p. 7. It is in the "getting of ideas and making observations" that records play an important role.

## DEVELOPMENT OBJECTIVES

Attention was paid to developing a system that would be respected by farmers and the business community. Requirements of farm management advisors, extension workers, accountants, tax consultants and lenders were taken into account. Generally accepted accounting

principles became the central focus<sup>3</sup>. The challenge was to portray accounting procedures simply and with special application to farmers<sup>4</sup>. As a result of the main concern — that a farm record system can be successful only if the farmer can understand it and as a result communicate better in the business community — the system was built to satisfy the following points:

- a) It is adaptable: it has a basic structure with optional extras depending upon the needs of the farmer. He can progress easily, at no time becoming locked in to one level and having to discard one concept in order to learn a new one. It serves as an educational tool for the farmer to improve his understanding of financial reports.
- b) It avoids using highly technical terms: jargon has been eliminated and codes are kept at a minimum. Transactions are recorded completely and simply as they happened and in terminology familiar to the farmer.
- c) It follows standard practices of the business community: farm management information based upon accepted accounting principles is provided for the farmer to use as he obtains advice and service from his extension advisor, banker or accountant. Reports are provided in a format familiar to these people.
- d) It is concise yet complete: transactions are balanced through the equation: Assets = Liabilities + Owners Equity. Reports are presented so that important information is summarized on one page with detail available on back-up schedules.
- e) Its accuracy can be verified: an audit trail is provided so that information on reports can be traced and verified with documents issued by suppliers, credit agencies and other businesses the farmer deals with.
- f) It is flexible: transaction details are stored in a computer in their original detail so that a variety of report formats are available and so that data can be retrieved at whatever level of aggregation required for research purposes. In this way it is adaptable to meet information needs in a changing agricultural environment.
- g) It can handle simple or complex transactions: the input procedures are designed so that even detailed or difficult transactions are handled easily.

<sup>3</sup>Generally accepted accounting principles although integrated throughout the system are not directly reviewed in this paper. For a good treatment see R.M. Skinner, FCA, published by the Canadian Institute of Chartered Accountants.

<sup>4</sup>Farmers generally do not have a great liking for bookkeeping although increasingly they see the need for it. Thus, avoiding technical accounting and computer jargon is essential to their acceptance.

- h) Farm information is treated with confidence: only those people authorized by the farmer are allowed access to his information.
- i) The system is fast: reports are mailed back to the farmer no later than 13 days after receipt of his input and often within five or six days.

## REPORTING INFORMATION

A fundamental requirement for a farm business is its ability to generate profit and its capacity to support the farmer and his family. The purpose of an accounting system is to show how well a business is doing this. The CANFARM system produces a FARM INCOME STATEMENT (profit and loss statement) and a STATEMENT OF ASSETS, LIABILITIES AND OWNER'S EQUITY (balance sheet) to show the profitability and financial strength of the business. Figure 1 shows the relationship of these two summary reports to the detailed reports and to the recording of transactions. Samples of the two statements appear as Figures 2 and 3 (not exact reproductions of Canfarm reports).

Care has been taken to present information clearly and concisely. For example, summary reports never exceed one page in length. The length of detail reports varies with the amount and detail of data recorded. However, the farmer can choose to receive only those reports he wants and at the time he wants them. He may want some reports monthly, quarterly, only in specified months or not at all. In this way he can eliminate the frequently occurring problem in the computer age, namely that of being buried by paper. The reports are in a format generally accepted by farm management extension workers, bank managers, accountants and tax consultants. This enables the farmer to obtain better financial advice more quickly and at lower cost.

## Measuring Profit and Financial Strength

The STATEMENT OF ASSETS, LIABILITIES AND OWNER'S EQUITY, as its name implies, shows the value of assets in the business, the claims against it by creditors and the portion belonging to the owner. This statement provides as much detail as possible without becoming cluttered and is arranged to show the liquidity and strength of the business. An essential feature of a balance sheet is that changes in equity from the beginning of the year to the end are accounted for. In Figure 2 owner's equity is shown to have increased from \$157,607 to \$173,809. This is partly due to a net farm income of \$29,835, the details of which are shown on the FARM INCOME STATEMENT (Figure 3). Other changes are accounted for by contributions, withdrawals, gains or losses on asset disposals, etc., for which

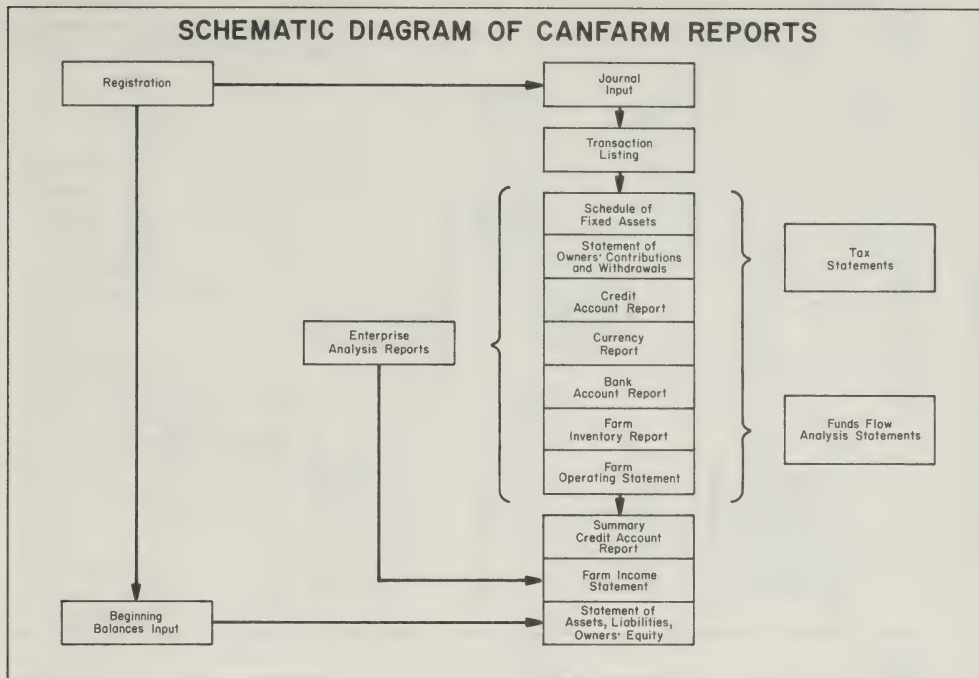


Figure 1

detailed reports are available. To understand the exact nature of these equity changes or the detail behind any of the summary figures the farmer can turn to the detailed report.

The analysis of financial strength and profitability begins with the summarized balance sheet and profit and loss statement. But often more detail is needed. For example, the FARM INCOME STATEMENT summarizes the major income and expense items and displays the net income figure. Details of income and expenses including the month or quarter in which they occurred appear on the FARM OPERATING STATEMENT. This report helps the farmer monitor the profitability of his farm as the year progresses. At the farmer's option this report can show only financial information or can be supplemented with quantity information as well.

The STATEMENT OF ASSETS, LIABILITIES AND OWNER'S EQUITY, in its equity section, summarizes the withdrawals and contributions taken from and made to the business by the owners. The STATEMENT OF OWNER'S CONTRIBUTIONS AND WITHDRAWALS shows this in itemized detail, monthly and quarterly. Although major inventory items appear directly on the

balance sheet, an INVENTORY REPORT is available showing the detail of crops, livestock and supplies on hand including notations on per unit values in dollars. Detail about fixed assets is provided in the SCHEDULE OF FIXED ASSETS AND DEPRECIATION (or C.C.A.) as back-up to summary information on the balance sheet and income statement.

A CREDIT ACCOUNT REPORT showing the detail of transactions is available to supplement the balance sheet. This indicates increases and decreases in accounts receivable, accounts payable and other liabilities. Similarly a BANK ACCOUNT REPORT shows deposits made and cheques written on particular bank accounts, including detail as to what the cheques were written for.

### Establishing Accuracy

Before analyzing his statements, the farmer needs to be sure they are accurate. An information and audit trail is provided allowing transactions to be traced through the system from the summary statements to source documents such as vouchers, cancelled cheques, deposit slips and bank statements which are the actual records of the transactions. For example, the balance sheet

JOHN DOE  
STATEMENT OF ASSETS, LIABILITIES AND OWNER'S EQUITY  
AS AT DEC. 31, 1977

731943

| *** ASSETS ***                 |         | REF<br>NO. | *** LIABILITIES ***     |           | REF<br>NO. |
|--------------------------------|---------|------------|-------------------------|-----------|------------|
|                                |         | 1977       |                         |           | 1976       |
| <b>CURRENT ASSETS</b>          |         |            |                         |           |            |
| Farm Bank                      |         | 4,032      | Charge Accounts         | 189       |            |
| Current Receivables            |         | 2,024      | Canadian Wheat          | 0         |            |
| Inventories                    |         |            | Board Advance           | 18,100    |            |
| Wheat                          | 18,711  |            | Bank Demand Notes       |           |            |
| Barley                         | 14,904  |            |                         |           |            |
| Hay                            | 10,000  |            |                         |           |            |
| Straw                          | 1,200   |            |                         |           |            |
| Total Crops Inventory          |         | 44,815     | TOTAL CURRENT           | 18,289    | 18,462     |
| Beef Cows                      | 25,200  |            | LIABILITIES             |           |            |
| Beef Breeding Heifers          | 9,200   |            |                         |           |            |
| Beef Heifer Calves             | 5,600   |            | TERM LIABILITIES        |           |            |
| Feeder Cattle                  | 5,100   |            | Farm Loans Improvement  | 6,300     |            |
| Other Livestock                | 3,725   |            | Bank Non-FIL            | 19,000    |            |
| Total Livestock Inventory      |         | 48,825     | Credit Union            | 1,000     |            |
| Total Supplies Inventory       |         | 1,100      | Farm Credit Corporation | 58,000    |            |
|                                |         |            | TOTAL TERM LIABILITIES  | 84,300    | 75,500     |
|                                |         |            |                         |           |            |
| TOTAL CURRENT ASSETS           |         | \$100,796  | TOTAL LIABILITIES       | \$102,589 | \$93,962   |
| <b>FIXED ASSETS (AT COST)</b>  |         |            |                         |           |            |
| Land and Improvement           | 101,800 |            | *** OWNER'S EQUITY ***  |           |            |
| Buildings and Structures       | 20,159  |            | OWNER'S EQUITY JAN. 1   | 157,607   |            |
| Machinery and Equipment        | 94,238  |            | Owner's Contributions   | 299       |            |
| Less: Accumulated Depreciation | 40,595  |            | Owner's Withdrawals     | -16,273   |            |
|                                |         |            | Net Farm Income         | 29,835    |            |
|                                |         |            | Gain on Asset Disposal  | 2,340     |            |
| TOTAL UNDEPRECIATED COST       |         | 175,602    | OWNER'S EQUITY DEC. 31  | 173,809   | 157,607    |
| <b>OTHER ASSETS</b>            |         |            |                         |           |            |
| Intangibles (Quotas, Etc.)     | 700     |            |                         |           |            |
| Less: Accumulated Amortization | 700     |            |                         |           |            |
| TOTAL OTHER ASSETS             |         | 0          |                         |           |            |
|                                |         |            |                         |           |            |
| TOTAL ASSETS                   |         | \$276,398  | TOTAL LIABILITIES AND   | \$276,398 | \$251,569  |
|                                |         |            | OWNER'S EQUITY          |           |            |
| LAND AND IMPROVEMENTS          |         | \$137,000  |                         |           |            |
| BUILDINGS AND STRUCTURES       |         | 41,050     |                         |           |            |
| MACHINERY AND EQUIPMENT        |         | 82,844     |                         |           |            |
| INTANGIBLES (QUOTAS, ETC.)     |         | 500        |                         |           |            |

Figure 2

JOHN DOE  
FARM INCOME STATEMENT  
JAN. 1, 1977 TO DEC. 31, 1977

731943

|  | 1977   | REF.<br>NO.     |
|--|--------|-----------------|
| INCOME                                       |        |                 |
| Wheat  | 35,919 |                 |
| Barley                                       | 4,361  |                 |
| Total Crops                                  |        | 40,280          |
| Feeder Cattle                                | 9,321  |                 |
| Beef Breeding Heifers                        | 8,046  |                 |
| Beef Bull                                    | 1,665  |                 |
| Beef Cows                                    | 766    |                 |
| Total Livestock                              |        | 19,797          |
| Canadian Wheat Board Payment                 | 7,131  |                 |
| Patronage Payments                           | 505    |                 |
| Total Supplies and Services                  |        | 7,636           |
| TOTAL INCOME                                 |        | <u>\$67,713</u> |
| EXPENSES                                     |        |                 |
| Total Crops                                  |        | 150             |
| Feeder Cattle                                | 2,625  |                 |
| Beef Bull                                    | 875    |                 |
| Beef Cows                                    | 840    |                 |
| Total Livestock                              |        | 4,340           |
| Interest                                     | 8,137  |                 |
| Chemical Fertilizer                          | 2,179  |                 |
| Hired Labor                                  | 1,242  |                 |
| Gasoline                                     | 925    |                 |
| Property Tax                                 | 897    |                 |
| Bale or Twine                                | 783    |                 |
| Equipment Repairs                            | 783    |                 |
| Commercial Feeds                             | 760    |                 |
| Herbicides                                   | 674    |                 |
| Other Supplies and Services                  | 6,071  |                 |
| Total Supplies and Services                  |        | 22,450          |
| TOTAL EXPENSES                               |        | <u>\$26,940</u> |
| EXCESS OF INCOME<br>OVER EXPENSES            |        | 40,773          |
| ADD: INVENTORY DEC. 31                       |        | 94,750          |
| LESS: INVENTORY JAN. 1                       |        | 100,290         |
| LESS: DEPRECIATION AMOUNT<br>FOR THIS PERIOD |        | 5,387           |
| NET FARM INCOME                              |        | <u>\$29,835</u> |

Figure 3

shows the bank balance at the beginning and end of year. The BANK ACCOUNT REPORT shows the detail of all transactions involving the bank and allows the farmer to check his balance through the year. The report is set up so that it can be reconciled with the statement issued by the bank. Discrepancies can then be identified and corrected either by the bank or the farmer depending on the source of error. To aid in verifying record accuracy, each bank entry is tied directly to the transaction listing and journal form. With a reasonably well-organized filing system, the farmer can trace the bank balance on the balance sheet right back to the source documents.

As with bank balances, credit account balances appearing on the balance sheet can be verified against records supplied by the credit agency by using the CREDIT ACCOUNT REPORT.

### **Income Tax Reporting**

Income tax undoubtedly provides a strong motivation for farmers to keep records. Consequently CANFARM has paid a great deal of attention to this area.

Farmers have the option of filing their income tax returns on either the cash or the accrual basis. The system provides a statement of INCOME FOR TAX PURPOSES for either at the farmer's option.

The tax statement begins with the information taken from the FARM OPERATING STATEMENT and allows the farmer to make those adjustments needed to conform to tax regulations and his own special circumstances. Because accuracy of the records can easily be established, the farmer and his accountant can be confident that the tax information is also correct. The farmer can obtain tax management reports before his fiscal year-end, allowing him to estimate his taxable income for the year in sufficient time to adjust his income level by selling more products or purchasing inputs for use the next year.

Handling fixed assets for tax purposes presents considerable problems to farmers. The system has been designed to handle these complex and tedious calculations in a simple manner. When a piece of equipment is sold for more than its original cost, the farmer may take advantage of lower taxes by showing the excess as a capital gain rather than income through recaptured capital cost allowance. The system keeps track of all the farmer's machines and equipment individually, making it easier for him to take this advantage. Examples are the treatment of eligible capital properties (quotas) and special write-offs for grain storage equipment. The

methods used for these and other special tax situations have been checked with Revenue Canada. Tax regulations are continually under review by CANFARM staff to ensure that the system remains up to date.

As accountants become increasingly aware of the system, farmers should be able to get better service from them. The accountant's time will not be taken up with clerical bookkeeping. Instead he can spend his time giving tax-saving and other management advice. He can do this with confidence because he can easily subject the farmer's records to his own tests of accuracy.

### **Financial Analysis**

An important role of the farm manager is seeing that his business generates sufficient funds to meet obligations as they fall due and to take advantage of investment opportunities for idle cash. While the STATEMENT OF ASSETS, LIABILITIES AND OWNER'S EQUITY and the FARM INCOME STATEMENT provide a good picture of the farm's profitability and financial strength, additional information is necessary as to the availability of cash for critical investment and loan repayment schedules. The system also produces two financial flow reports, namely the CASHFLOW STATEMENT and the STATEMENT OF CHANGE IN FINANCIAL POSITION. They are useful to the farmer in monitoring his cash position and in working out his financial affairs with his bank and other credit agencies.

### **Enterprise Information**

Knowing the relationship of one enterprise to another and the contribution each makes to farm profitability is useful in making production and organizational decisions. For those farmers wishing income and expense information reported on this basis as well as for the total farm, enterprise reports are available. First, the farmer decides the particular areas of profit and cost he needs information for and registers the necessary enterprises and accounts. Then, when recording transactions he indicates the enterprise or account involved.

If he wants detail on particular parts of an enterprise such as a pen of feeder cattle or a batch of broilers, he can register a "lot". A record of costs and returns for the total production cycle is then available to him even when it starts in one fiscal year and ends in the next. Feeder cattle are a good example.

### **Production Information**

Quantitative information such as tons of fertilizer bought or used, bushels of wheat harvested or sold and

the number of head and weight of feeders bought, sold or on inventory is useful to determine the efficiency of a farming operation. It is essential for determining production coefficients to use in planning. Farmers can record such information if they wish and thus supplement the financial information shown on the reports already discussed. As an added feature for those who desire it, the system has a built-in check on selected items (selected by the farmer) to ensure quantities are consistently recorded.

## RECORDING DATA

Good business practices and a well-prepared farmer go a long way toward simplifying the recording job. Although some inroads are being made in farmer training, insufficient help to farmers in organizing their desks probably is the main reason why they abandon accounting systems. Even if they don't give up they may feel they are not getting as much out of it as they should or want for the amount of time they put into it. If the CANFARM system is backed up by sound business practices and good recording habits, it allows the farmer to keep control of his affairs with a minimum of effort. Most of the business community operates on a monthly schedule (e.g., bank statements, farm supply invoices). Hence it is advantageous to the farmer to organize his affairs and do his recording on the same schedule. The CANFARM system has the advantage of summarizing his affairs monthly so that he can reconcile his accounts to those of the businesses he deals with. Even though monthly recording does offer considerable advantages, the system is flexible so that the farmer can adopt a less rigid schedule if he wishes.

Traditional farm management oriented accounting books accommodate simple situations in a straightforward manner, but become extremely involved when faced with complicated yet common transactions. CANFARM has overcome this common failing and handles all transactions with relative ease. This is the test of a good accounting system. CANFARM has achieved this through the application of generally accepted accounting principles. These concepts, which are consistent and general, have evolved over centuries in the business community and are used there simply because they work.

Recording transactions, monthly or otherwise, is done primarily on the DAILY JOURNAL form as shown in Figure 4. In accordance with standard accounting practice all of the essential information describing a transaction must be entered. This means recording what was sold or bought and where the money came from or

went. This is like the bookkeeping of any business, but to minimize jargon the farmer does not need to express his transactions in terms of debits and credits. Instead, the journal is structured so that the column headings are a series of questions familiar to him. Because every possibility must be covered, a first glance at the form causes reactions like "there are too many columns". But in testing workshops it was found that farmers were able to master the concept quickly and record transactions accurately within half an hour of exposure to the form.

## Examples

To illustrate, five typical transactions have been recorded in Figure 4. They range in complexity from simple purchases and sales to sales involving numerous deductions and assignments.

In the first instance a cheque for \$17.53 is written to pay the telephone bill. The recording is done by noting first that the bank account is involved and then noting that the telephone expense has been increased. The consequences of this transaction are that the FARM OPERATING STATEMENT shows an increase of \$17.53 in expenses and the BANK ACCOUNT REPORT shows a decreased balance of \$17.53.

The second, third and fourth instances involve recording an income, a purchase on credit and a payment on account. Transactions on a farm occur in various combinations and extensions of these four instances. The fifth instance, which is not unusual, illustrates this. Here, as can be seen from the source documents in Figure 5, the farmer receives his milk cheque for \$2,596.64 and deposits it in the bank, less \$500 which he keeps in cash for living costs. The gross amount of milk sales is \$2,903.44 but there are costs like trucking, marketing fees and club memberships to be deducted. Also he has an arrangement whereby he assigns \$133 of his monthly cheque to the Farm Credit Corporation to pay off his mortgage. There are eight elements in the overall transaction and are recorded using eight lines on the journal form. The elements of the transaction are reported on the appropriate statements, yet the complete transaction is retained on the TRANSACTION LISTING for audit purposes. The TRANSACTION LISTING is also used for correcting transactions that were recorded wrongly.

In all cases, whether the transaction is simple or complex<sup>5</sup>, it must balance. For example, the \$17.53

<sup>5</sup> It is the actual transaction between the farmer and the person or business he deals with to which we refer as complex, not to the recording of it.

J10

1

[illegible]

Figure 4

telephone expense is balanced by a cheque written on the bank for \$17.53. The gross milk sales less marketing costs are balanced with the bank deposit made, the cash kept on hand, the various deductions and the repayment of the loan. Completeness makes recording straightforward for the farmer and provides a good information trail for him.

INFORMATION FOR RESEARCH AND  
POLICY

An important objective of CANFARM beyond the farmer's immediate purposes is that the system serve as a collection vehicle for data for research and policy. Balance sheet and income information are available for these purposes from those farmers who have agreed in advance to let their data be used. Data are released without violating the confidentiality and privacy of those farmers. CANFARM's experience has been that over 90 percent of the farmers enrolled have agreed to data release.

While this passive approach to data collection does provide some useful, although general information about the performance of farms, a more active approach is gaining popularity. The approach is to plan the research project, select a sample of farms that fit the research criteria and then register these specifically to record the required information. A number of applications of the farm record system to specific research projects are underway, including the Western Grain Stabilization project and the Ontario Dairy Study. In this way the information needs of the farmer and the researcher are simultaneously satisfied with minimum additional costs to the farmer.

## SUMMARY AND CONCLUSIONS

The CANFARM farm record system has undergone a major redevelopment in the last few years. Although the main task has been completed and the new system is

SOURCE DOCUMENTS FOR TRACING CANFARM TRANSACTIONS

|                       |      |             |
|-----------------------|------|-------------|
| CREDIT ACCOUNT        |      | ACCOUNT NO. |
| April 25 19 74        |      | 1248        |
| NAME JOHN DOE         |      |             |
| X 1                   |      |             |
| X 2                   |      |             |
| X 5                   |      |             |
| X 10                  |      |             |
| X 20                  |      |             |
| X 50                  |      |             |
| X 100                 |      |             |
| COIN                  |      |             |
| TOTAL CASH ▶          |      |             |
| TOTAL CHEQUES         | 2596 | 64          |
| SUB TOTAL             | 2596 | 64          |
| CASH                  | 500  | 00          |
| TOTAL ▶               | 2096 | 64          |
| DEPOSITED BY John Doe |      |             |

| STATEMENT FOR MARCH 1974 |    |       |    |    |       |    |    |       |    |        |       |
|--------------------------|----|-------|----|----|-------|----|----|-------|----|--------|-------|
| 1                        | 2  | 2,189 | 3  | 4  | 2,142 | 5  | 6  | 2,252 | 7  | 8      | 2,215 |
| 9                        | 10 | 2,158 | 11 | 12 | 2,185 | 13 | 14 | 2,142 | 15 | 16     | 2,127 |
| 17                       | 18 | 2,170 | 19 | 20 | 2,166 | 21 | 22 | 2,150 | 23 | 24     | 2,154 |
| 25                       | 26 | 2,056 | 27 | 28 | 2,211 | 29 | 30 | 2,326 | 31 | TOTAL  |       |
|                          |    |       |    |    |       |    |    |       |    | 32,643 |       |

| DETAIL          |        | QUANTITY             | BUTTER % |      | % PROTEIN |          | % LACTOSE |      | TOTAL SOLIDS % |               | OTHERS |             |
|-----------------|--------|----------------------|----------|------|-----------|----------|-----------|------|----------------|---------------|--------|-------------|
| NUMBERS OF DAYS | 30     | LAST MONTH'S         | 4.15     | 3.43 | 4.83      | BACTERIA | 1         |      |                |               |        |             |
|                 | 981    | 1ST HALF             | 4.10     | 3.43 | 4.95      |          |           | MELT | 1              |               |        |             |
|                 | 29,430 | 2ND HALF             | 4.10     | 3.55 | 5.00      |          |           |      |                | FEEBLES WATER | NO     |             |
|                 | 3,213  | THIS MONTH'S AVERAGE | 4.10     | 3.49 | 4.98      |          |           |      |                |               |        | ANTIBIOTICS |

| ANNUAL MARKET SHARING QUOTA |  | AVAILABLE NEXT YEAR |  | AVAILABLE THIS YEAR |  | AVAILABLE 1980 |  | OVER 10% OF CLASS 1 & 2 SALES |  | MARKET SHARING QUOTA |  |
|-----------------------------|--|---------------------|--|---------------------|--|----------------|--|-------------------------------|--|----------------------|--|
| 167,081                     |  | 167,081             |  | 167,081             |  | 167,081        |  | 45,447                        |  | 121,634              |  |

| USAGE       | BASE PRICE | PERCENTAGE | POUNDS | PRICE | AMOUNT        |
|-------------|------------|------------|--------|-------|---------------|
| CLASS 1 - 2 | 9.128      | 86.49      | 25,454 | 9.638 | 2,453.26      |
| CLASS 3 - 6 | 5.752      |            | 7,189  | 6.262 | 450.18        |
|             |            |            |        |       | VALUE OF MILK |
|             |            |            |        |       | 2,903.44      |

| PRIMARY TRANSPORTATION |  | SECONDARY TRANSPORTATION |  | RATE |  | PRIMARY EXTRA |  | TRANSPORTATION |  |
|------------------------|--|--------------------------|--|------|--|---------------|--|----------------|--|
| .3800                  |  | 124.04                   |  |      |  |               |  | 124.04         |  |

|             |                    |                      |                   |                  |
|-------------|--------------------|----------------------|-------------------|------------------|
| 16.32       | 4.90               | 14.69                | 3.37              | 39.28            |
| LICENCE FEE | NATIONAL PROMOTION | PROVINCIAL PROMOTION | WITHIN QUOTA LEVY | BOARD DEDUCTIONS |

| BOARD RET. |  | DATE          |  | DESCRIPTION                    |  | AMOUNT        |  |
|------------|--|---------------|--|--------------------------------|--|---------------|--|
|            |  | MO   DAY   YR |  |                                |  |               |  |
|            |  |               |  | ASSIGNMENT SERVICE FEE MONTHLY |  | 30 -          |  |
|            |  |               |  | ONTARIO JERSEY CLUB            |  | 10.18 -       |  |
|            |  |               |  | FARM CREDIT CORPORATION I      |  | 133.00 -      |  |
|            |  |               |  |                                |  | MISCELLANEOUS |  |
|            |  |               |  |                                |  | 143.48 -      |  |

|                     |  |                |  |                  |  |               |  |          |  |
|---------------------|--|----------------|--|------------------|--|---------------|--|----------|--|
| 2,903.44            |  | 124.04         |  | 39.28            |  | 143.48 -      |  | 2,596.64 |  |
| TOTAL VALUE OF MILK |  | TRANSPORTATION |  | BOARD DEDUCTIONS |  | MISCELLANEOUS |  |          |  |

RETAIN FOR INCOME TAX PURPOSES

Figure 5

operational, work is still underway to build components to handle labor payroll records and to deal with the special circumstances of partnerships and corporations.

Because agriculture is dynamic, CANFARM development staff recognize that the system must be continually examined to remain relevant to the industry it serves. The emphasis now, however, must shift from a development phase to making the system an integral tool for the work of farm management professionals across Canada.

## REFERENCES

1. Warren, G.F., Farm Management, The MacMillan Company, New York, 1917.
2. Macdonald College Seminar on Electronic Farm Accounting, November 1962.
3. Plaunt, D.H., "Canada's Experience in and Aspirations for a Comprehensive Farm Data System", *Journal of Farm Economics*, Vol. 49, No. 5, December 1967.

# LEAST-COST MACHINE SIZES FOR CEREAL TILLAGE AND SEEDING IN THE MARITIMES



*There are many combinations of machines and machine sizes to choose from for cereal tillage and seeding. There are many implement-size combinations whose costs are within 10 percent of the least-cost solution for any given acreage and cultural practice.*

*The least-cost implement size combination is specific for each acreage, cultural practice, soil, climate and crop value.*

*J.A. McIsaac and James Lovering\**



## INTRODUCTION

Machinery investment is about 14 percent of total farm investment in Canada and about 10 percent in the Maritime region. Machinery operating costs are about 19 percent and 16 percent of total operating costs in Canada and the Maritimes, respectively [5].

The choice of machine size relative to the size of the task it is to perform can have an important bearing on farm machinery investment and operating costs.

The objective in choosing least-cost implement sizes for cereal tillage and seeding is to minimize the sum of variable and fixed implement and tractor costs, labor costs and the value of the reduction in crop yield resulting from late seeding (penalty).

For any particular acreage, implement size determines implement costs, labor costs and penalty. Large implements can complete a task more quickly than smaller ones, resulting in lower labor costs and lower penalty. Large implements, however, would have higher fixed costs.

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The purpose of this paper is to indicate, for several typical cultural practices<sup>1</sup> in the Maritimes, (a) least-cost implement sizes, (b) total costs of tillage and seeding operations and (c) the effects of changes in implement, labor and cereal prices, acreage, work-day probability and draft requirements on least-cost sizes and on tillage and seeding costs. The standard cultural practice used in this paper comprises plowing (half in the fall, half in the spring), disking twice, harrowing once (spring tooth) and seeding.

## METHOD AND DATA

A previously described model [3] is used to determine least-cost implement and tractor sizes and costs for cereal tillage and seeding in a particular, or for the purposes of this study, standard situation. The relevant variables for least-cost implement size determination are: acreage to be seeded; number and kinds of field operations to be performed; implement sizes available; proportion of tillage work done in the spring; number of hours available for field work before the date at which crop yields begin to decline as a result of late seeding; probability that any given day will be suitable (in terms of weather) for field work; rate at which crop yield declines after a specified date of seeding; power required to pull a unit width of each implement and unit prices of tractors, implements, labor, fuel and the cereal to be grown. Subsequently, changes in these factors, alone and

<sup>1</sup>Number, kind and season of field operations (Table 7)

in selected combinations, were made to determine their effects on least-cost sizes of tillage and seeding implements and on the costs of these operations. See the Appendix for values assigned to these factors for the analysis in this paper.

The choice of acreage and cultural practice was made in consultation with production specialists in the Prince Edward Island Department of Agriculture and Forestry. Unit-of-capacity implement prices were calculated from 1975 price books of major manufacturers. Implement field efficiencies and operating speeds are those observed in unpublished work studies in Prince Edward Island. Implement power requirements were taken from the Agricultural Engineers' Yearbook [1].

All possible combinations of implement sizes (within defined ranges) and all possible allocations of implements to tractors were considered in determining least-cost implement sizes (Table 1).

Penalty calculations were based on research conducted at the Agriculture Canada Research Station at Charlottetown to determine the effects of seeding dates on cereal crop yields [4]. Data from these experiments indicate that yields of barley are reduced by about one bushel per acre for each day that seeding is delayed beyond the optimum planting date. Yield reductions for oats and wheat are similar — about 50 pounds per acre per day.

A linear crop-loss function closely represents the planting date-yield data from Charlottetown. The data show that there is not much yield reduction before the optimum planting date and that the yield declines in a linear fashion after that date. Other areas and other crops may very well have different crop-loss functions.

The probability of occurrence of a work-day was used in finding the time available for field operation in the spring. Information on spring soil moisture was collected along with a record of when farmers could work in the fields. The soil data necessary to calculate work-day probabilities according to Baier's versatile soil moisture budget [2] were collected. The soil moisture budget was run for 40 years of weather data from the Charlottetown area<sup>2</sup>. The work-days and non-work-days calculated from the soil moisture budget were checked against information collected from farm operators to ensure

**TABLE 1. TRACTOR-IMPLEMENT COMBINATIONS CONSIDERED**

| Combination | Tractor 1               | Tractor 2               |
|-------------|-------------------------|-------------------------|
| 1           | Plow and Disc           | Harrow and Seeder       |
| 2           | Plow and Harrow         | Disc and Seeder         |
| 3           | Plow and Seeder         | Disc and Harrow         |
| 4           | Plow                    | Disc, Harrow and Seeder |
| 5           | Plow, Harrow and Seeder | Disc                    |
| 6           | Plow, Disc and Seeder   | Harrow                  |
| 7           | Plow, Disc and Harrow   | Seeder                  |
| 8           | All Implements          | None                    |

that the soil budget output was acceptable. The 40-year average work-day probability was used for the spring tillage and seeding period.

The implement work rates and work-day probability were used to determine the acreage seeded before yield loss begins. Then, work-day probability, implement work rates and crop-loss rates were used to calculate penalty costs on the acreage remaining to be seeded.

## ANALYSIS

Figure 1 shows the relationships among acreage, total cost and costs per acre of tillage and seeding for acreages

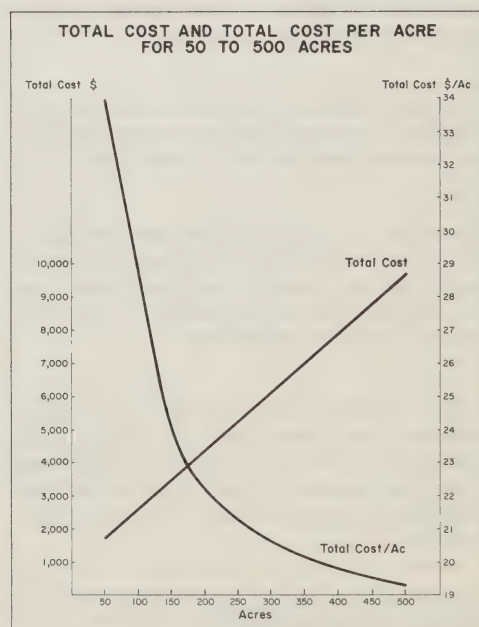


Figure 1

<sup>2</sup>A. Bootsma, Agroclimatologist, Prince Edward Island Department of Agriculture and Forestry, collected the soil data needed for the budget. The budget was run by W. Baier.

**TABLE 2. LEAST-COST IMPLEMENT SIZES AND COSTS FOR 50 TO 500 ACRES**

| Area<br>— acres — | Combi-<br>nation<br>— no. — | Tractor 1<br>Size<br>— hp — | Tractor 2<br>Size | Implement Sizes |        |        |        | Costs |                         |         |       |          |
|-------------------|-----------------------------|-----------------------------|-------------------|-----------------|--------|--------|--------|-------|-------------------------|---------|-------|----------|
|                   |                             |                             |                   |                 |        |        |        |       |                         |         |       |          |
|                   |                             |                             |                   | Plow            | Disc   | Harrow | Seeder | Labor | Tractor &<br>Implements | Penalty | Total | Per Acre |
|                   |                             |                             |                   | — furrows —     | — ft — |        |        |       |                         | — \$ —  |       |          |
| 50                | 8                           | 26.7                        | —                 | 2               | 6      | 6      | 6      | 385   | 1,280                   | 31      | 1,696 | 33.92    |
| 100               | 2                           | 30.4                        | 25.2              | 2               | 6      | 8      | 8      | 762   | 1,994                   | 104     | 2,860 | 28.60    |
| 150               | 5                           | 40.0                        | 25.2              | 3               | 6      | 10     | 12     | 803   | 2,487                   | 264     | 3,554 | 23.69    |
| 200               | 3                           | 40.0                        | 53.2              | 3               | 12     | 14     | 12     | 842   | 3,339                   | 230     | 4,411 | 22.05    |
| 250               | 3                           | 53.3                        | 68.4              | 4               | 16     | 18     | 16     | 792   | 4,371                   | 146     | 5,309 | 21.24    |
| 300               | 3                           | 53.3                        | 68.4              | 4               | 16     | 18     | 16     | 951   | 4,442                   | 803     | 6,196 | 20.65    |
| 350               | 3                           | 66.7                        | 84.0              | 5               | 20     | 22     | 20     | 889   | 5,483                   | 617     | 6,989 | 19.97    |
| 400               | 3                           | 80.0                        | 100.8             | 6               | 24     | 26     | 24     | 848   | 6,549                   | 499     | 7,896 | 19.74    |
| 450               | 3                           | 81.2                        | 109.2             | 6               | 26     | 28     | 28     | 895   | 7,032                   | 833     | 8,760 | 19.47    |
| 500               | 3                           | 93.3                        | 117.6             | 7               | 28     | 30     | 28     | 910   | 7,686                   | 1,071   | 9,667 | 19.33    |

ranging from 50 to 500. Least-cost equipment sizes were determined for areas from 50 to 500 acres in increments of 50 acres. Two tractors are indicated for each acreage over 50. On 100-acre farms, the least-cost allocations of implements are plow and harrow to one tractor and disc and seeder to the other. On 150-acre farms the allocations are plow, harrow and seeder to one tractor and disc to the other. For 200 acres and over they are disc and harrow to one tractor and plow and seeder to the other. Table 2 lists least-cost tractor and implement sizes and costs as well as labor and penalty costs for farms ranging in size from 50 to 500 acres.

Total tillage and seeding costs per acre decrease rapidly with increasing acreage because labor costs drop as acreage and implement sizes increase.

Figure 2 shows the relationship between various components of total cost and sizes of implements when one tractor is used and when the area to be seeded is 200 acres. Implement capacities corresponding to the size indexes used in Figure 2 are given in Table 3. The most important fact shown in Figure 2 is that a relatively wide range of implement sizes (indices 4, 5, 6 and 7) is within 12 percent of the least-cost implement size<sup>3</sup>. The trade-offs between labor, machinery and penalty components of total cost are presented in this figure.

Figure 3 and Table 4 show the nature and extent of the effects of: (a) severity of penalty, (b) loss-free time (the time available before crop loss begins) and (c) the probability of occurrence of days suitable for field work on: (1) least-cost implement sizes and (2) total cost of tillage and seeding. The influence of penalty changes on total

costs becomes stronger as loss-free time and work-day probability become smaller. Also the effects of changes in work-day probability and loss-free time on total costs become stronger as the penalty increases.

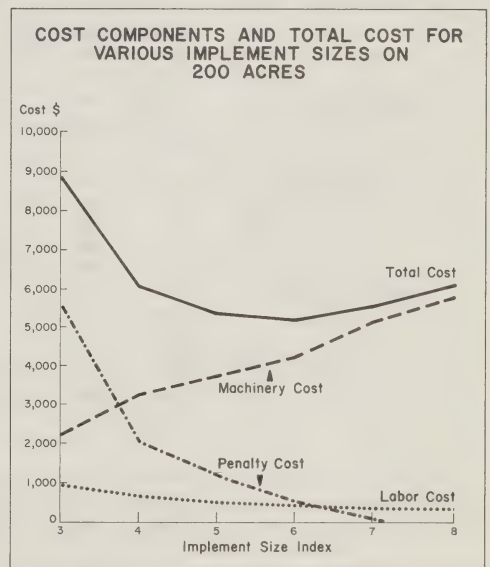


Figure 2

Table 4 shows that changes in least-cost implement sizes in response to changes in work-day probability and loss-free time and in penalty are approximately consistent with expectations: least-cost implement sizes increase as penalty increases and decrease with higher values for loss-free time and work-day probability.

<sup>3</sup>Least costly of the 10 sizes chosen for comparison

**TABLE 3. COSTS FOR 4 COMBINATIONS OF PLOW, DISC, HARROW AND SEEDER SIZES FOR THE SITUATION WHERE ONE TRACTOR IS USED ON 200 ACRES**

| Implement Size Index | Implement Size |      |        |        | Costs |                        |         |       |
|----------------------|----------------|------|--------|--------|-------|------------------------|---------|-------|
|                      | Plow           | Disc | Harrow | Seeder | Labor | Machinery <sup>a</sup> | Penalty | Total |
|                      | — furrows —    |      | — ft — |        |       | — \$ —                 |         |       |
| 4                    | 4              | 14   | 16     | 20     | 630   | 3,252                  | 2,026   | 5,908 |
| 5                    | 5              | 16   | 18     | 24     | 527   | 3,747                  | 1,125   | 5,399 |
| 6                    | 6              | 19   | 21     | 27     | 448   | 4,287                  | 499     | 5,234 |
| 7                    | 7              | 23   | 26     | 34     | 372   | 5,200                  | 89      | 5,661 |

<sup>a</sup>Includes tractors and implements.

**TABLE 4. TRACTOR-IMPLEMENT COMBINATIONS, IMPLEMENT SIZES AND COSTS FOR VARIOUS WORK-DAY PROBABILITIES, LOSS-FREE TIME AND CROP-LOSS FUNCTIONS ON 200 ACRES**

| LFT* | Crop Loss Rate | Tractor-Implement Combination | Machinery size |                |                 |        |    |    | Costs |                        |         |       |
|------|----------------|-------------------------------|----------------|----------------|-----------------|--------|----|----|-------|------------------------|---------|-------|
|      |                |                               | Tractor 1 Size | Tractor 2 Size | Implement Sizes |        |    |    | Labor | Machinery <sup>a</sup> | Penalty | Total |
|      |                |                               | — hp —         |                | — furrows —     | — ft — |    |    |       | — \$ —                 |         |       |
| A    | .1             | 3                             | 40             | 53             | 3               | 12     | 14 | 12 | 842   | 3,339                  | 850     | 5,031 |
|      | .2             | 3                             | 53             | 68             | 4               | 16     | 18 | 16 | 634   | 4,299                  | 614     | 5,547 |
|      | .3             | 3                             | 53             | 68             | 4               | 16     | 18 | 16 | 634   | 4,299                  | 920     | 5,853 |
|      | .4             | 3                             | 67             | 84             | 5               | 20     | 22 | 20 | 508   | 5,269                  | 319     | 6,096 |
|      | .5             | 3                             | 67             | 84             | 5               | 20     | 22 | 20 | 508   | 5,269                  | 399     | 6,176 |
|      | .6             | 3                             | 67             | 84             | 5               | 20     | 22 | 20 | 508   | 5,269                  | 479     | 6,256 |
| B    | .1             | 5                             | 53             | 34             | 4               | 8      | 14 | 16 | 799   | 3,320                  | 372     | 4,491 |
|      | .2             | 3                             | 40             | 53             | 3               | 12     | 14 | 12 | 842   | 3,339                  | 614     | 4,795 |
|      | .3             | 3                             | 53             | 61             | 4               | 14     | 16 | 12 | 718   | 3,932                  | 375     | 5,025 |
|      | .4             | 3                             | 53             | 68             | 4               | 14     | 18 | 16 | 634   | 4,299                  | 156     | 5,089 |
|      | .5             | 3                             | 53             | 68             | 4               | 16     | 18 | 16 | 634   | 4,299                  | 194     | 5,127 |
|      | .6             | 3                             | 53             | 68             | 4               | 16     | 18 | 16 | 634   | 4,299                  | 233     | 5,166 |
| C    | .1             | 5                             | 53             | 25             | 3               | 6      | 10 | 12 | 1,071 | 2,559                  | 494     | 4,124 |
|      | .2             | 5                             | 53             | 34             | 4               | 8      | 14 | 16 | 799   | 3,320                  | 219     | 4,338 |
|      | .3             | 3                             | 40             | 53             | 3               | 12     | 14 | 12 | 842   | 3,339                  | 230     | 4,411 |
|      | .4             | 3                             | 40             | 53             | 3               | 12     | 14 | 12 | 842   | 3,339                  | 306     | 4,487 |
|      | .5             | 3                             | 40             | 53             | 3               | 12     | 14 | 12 | 842   | 3,339                  | 383     | 4,564 |
|      | .6             | 1                             | 67             | 35             | 5               | 16     | 8  | 12 | 717   | 3,804                  | 126     | 4,647 |
| D    | .1             | 5                             | 40             | 25             | 3               | 6      | 10 | 12 | 1,071 | 2,559                  | 224     | 3,854 |
|      | .2             | 5                             | 40             | 25             | 3               | 6      | 10 | 12 | 1,071 | 2,559                  | 448     | 4,073 |
|      | .3             | 5                             | 53             | 34             | 4               | 8      | 14 | 14 | 823   | 3,251                  | 67      | 4,141 |
|      | .4             | 5                             | 53             | 34             | 4               | 8      | 14 | 14 | 823   | 3,251                  | 89      | 4,163 |
|      | .5             | 5                             | 53             | 34             | 4               | 8      | 14 | 16 | 799   | 3,320                  | 57      | 4,176 |
|      | .6             | 5                             | 53             | 34             | 4               | 8      | 14 | 16 | 799   | 3,320                  | 69      | 4,188 |

\*Loss-free time

A — Loss-free time = 45 hr and work-day probability = 0.3.

B — Loss-free time = 60 hr and work-day probability = 0.4.

C — Loss-free time = 75 hr and work-day probability = 0.5.

D — Loss-free time = 90 hr and work-day probability = 0.6.

<sup>a</sup>Includes tractors and implements.

**EFFECT OF CHANGES IN CROP-LOSS RATE  
AND WORK-DAY PROBABILITY ON TOTAL  
COST PER ACRE FOR STANDARD SITUATION**

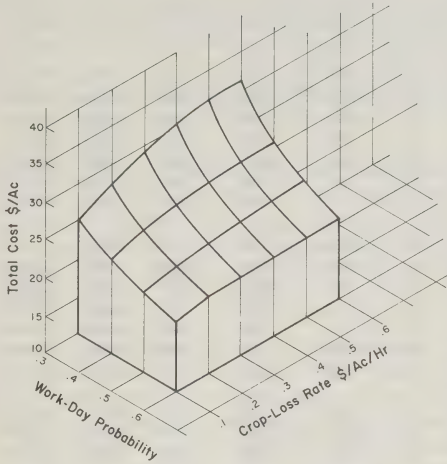


Figure 3

**EFFECT OF CHANGES IN CROP-LOSS RATE  
AND LABOR RATE ON TOTAL COST  
PER ACRE FOR STANDARD SITUATION**

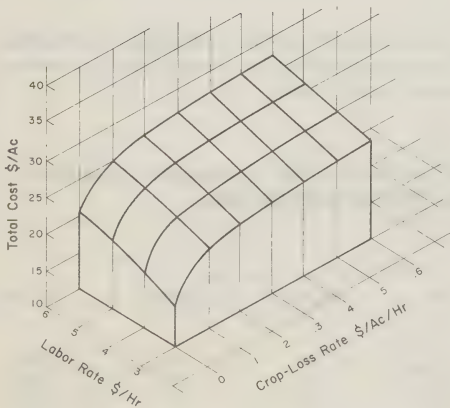


Figure 4

The relationship between total cost per acre, hourly cost of labor and penalty is shown in Figure 4. Least-cost implement sizes increase with increases in both labor price and penalty. Changing the crop-loss function from zero to \$0.60 per acre per hour results in total cost per acre changes of \$8.21 and \$6.17 for labor prices of \$3 and \$6 per hour, respectively. Changing the labor price from \$3 to \$6 per hour results in a change in total costs per acre of \$4.18 when the crop-loss function is \$0.30 per acre per hour. Table 5 shows that the least-cost implement size increases as both crop-loss function and labor price increase.

**EFFECT OF WORK-DAY PROBABILITY AND  
LOSS-FREE TIME ON TOTAL COST  
FOR STANDARD SITUATION**

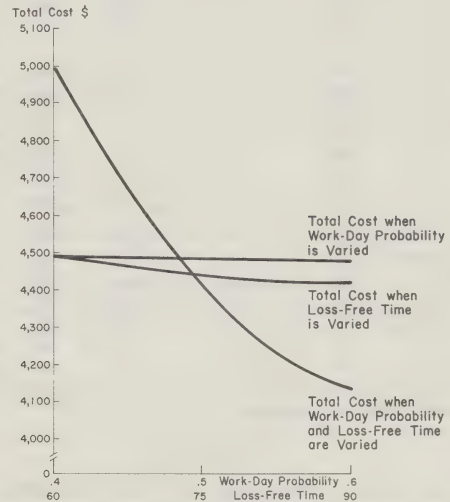


Figure 5

The effect of separate increases in work-day probability and loss-free time on total costs is much smaller than when they are examined together (Figure 5).

The relationship between the draft requirement per foot of implement width and total cost is linear. A 10-percent increase in the draft causes the total cost to increase 4.3 percent. The total cost relationship with machinery prices and fuel prices is also linear. A 10-percent increase in the machinery price increases the total cost 6.9 percent. A 10-percent increase in fuel cost increases the total cost 0.6 percent.

**TABLE 5. COSTS AND LEAST-COST IMPLEMENT SIZES FOR VARIOUS CROP-LOSS FUNCTIONS AND LABOR RATES**

| Crop Loss Rate | Labor Rate | Tractor-Implement Combination | Implement Sizes |        |        |        | Costs |                        |         |           | Total per acre |
|----------------|------------|-------------------------------|-----------------|--------|--------|--------|-------|------------------------|---------|-----------|----------------|
|                |            |                               | Plow            | Disc   | Harrow | Seeder | Labor | Machinery <sup>a</sup> | Penalty | Total     |                |
| — \$/ac/hr —   | — \$/hr —  | — no. —                       | — furrows —     | — ft — |        |        |       | — \$ —                 |         | — \$/ac — |                |
| 0              | 3          | 8                             | 2               | 6      | 6      | 8      | 1,429 | 1,575                  | 0       | 3,004     | 15.02          |
| .1             | 3          | 5                             | 3               | 6      | 10     | 12     | 1,071 | 2,559                  | 494     | 4,124     | 20.62          |
| .2             | 3          | 5                             | 4               | 8      | 14     | 16     | 799   | 3,320                  | 219     | 4,338     | 21.69          |
| .3             | 3          | 3                             | 3               | 12     | 14     | 12     | 842   | 3,339                  | 230     | 4,411     | 22.05          |
| .4             | 3          | 3                             | 3               | 12     | 14     | 12     | 842   | 3,339                  | 306     | 4,486     | 22.44          |
| .5             | 3          | 3                             | 3               | 12     | 14     | 12     | 842   | 3,359                  | 383     | 4,583     | 22.92          |
| .6             | 3          | 1                             | 5               | 16     | 8      | 12     | 717   | 3,804                  | 125     | 4,646     | 23.23          |
|                |            |                               |                 |        |        |        |       |                        |         |           |                |
| 0              | 4          | 8                             | 3               | 8      | 10     | 10     | 1,356 | 2,123                  | 0       | 3,479     | 17.40          |
| .1             | 4          | 5                             | 3               | 6      | 10     | 12     | 1,428 | 2,559                  | 494     | 4,481     | 22.41          |
| .2             | 4          | 5                             | 4               | 8      | 14     | 16     | 1,066 | 3,320                  | 219     | 4,605     | 23.03          |
| .3             | 4          | 3                             | 3               | 12     | 14     | 12     | 1,123 | 3,339                  | 230     | 4,692     | 23.46          |
| .4             | 4          | 3                             | 3               | 12     | 14     | 12     | 1,123 | 3,339                  | 306     | 4,768     | 23.84          |
| .5             | 4          | 3                             | 3               | 12     | 14     | 14     | 1,081 | 3,421                  | 340     | 4,842     | 24.21          |
| .6             | 4          | 1                             | 5               | 16     | 8      | 12     | 956   | 3,804                  | 126     | 4,886     | 24.43          |
|                |            |                               |                 |        |        |        |       |                        |         |           |                |
| 0              | 5          | 8                             | 3               | 8      | 10     | 12     | 1,622 | 2,189                  | 0       | 3,811     | 19.05          |
| .1             | 5          | 5                             | 4               | 8      | 14     | 16     | 1,332 | 3,320                  | 110     | 4,762     | 23.81          |
| .2             | 5          | 5                             | 4               | 8      | 14     | 16     | 1,332 | 3,320                  | 219     | 4,871     | 24.36          |
| .3             | 5          | 5                             | 4               | 8      | 14     | 16     | 1,332 | 3,320                  | 329     | 4,981     | 24.91          |
| .4             | 5          | 3                             | 3               | 12     | 14     | 14     | 1,351 | 3,421                  | 272     | 5,055     | 25.22          |
| .5             | 5          | 1                             | 5               | 16     | 8      | 12     | 1,195 | 3,804                  | 105     | 5,104     | 25.52          |
| .6             | 5          | 1                             | 5               | 16     | 8      | 12     | 1,195 | 3,804                  | 126     | 5,125     | 25.62          |
|                |            |                               |                 |        |        |        |       |                        |         |           |                |
| 0              | 6          | 8                             | 3               | 10     | 10     | 12     | 1,828 | 2,295                  | 0       | 4,123     | 20.62          |
| .1             | 6          | 5                             | 4               | 8      | 14     | 16     | 1,599 | 3,320                  | 110     | 5,029     | 25.14          |
| .2             | 6          | 5                             | 4               | 8      | 14     | 16     | 1,599 | 3,320                  | 219     | 5,138     | 25.69          |
| .3             | 6          | 5                             | 4               | 8      | 14     | 16     | 1,599 | 3,320                  | 329     | 5,248     | 26.24          |
| .4             | 6          | 1                             | 5               | 16     | 8      | 12     | 1,434 | 3,804                  | 84      | 5,322     | 26.61          |
| .5             | 6          | 1                             | 5               | 16     | 10     | 12     | 1,376 | 3,878                  | 86      | 5,340     | 26.70          |
| .6             | 6          | 1                             | 5               | 16     | 10     | 12     | 1,376 | 3,878                  | 103     | 5,357     | 26.79          |

<sup>a</sup>Includes tractor and implements.

The proportion of the tractor fixed costs and repairs that are charged to cereal tillage and seeding influences the total cost of the least-cost solution. Table 6 shows that the total cost in the least-cost solution increases and

the implement sizes remain constant as the proportion of tractor costs charged to cereal tillage and seeding increases from 0.2 to 0.6.

**TABLE 6. TOTAL COST AND LEAST-COST IMPLEMENT SIZES FOR THE STANDARD SITUATION BY PROPORTION OF TRACTOR COSTS CHARGED TO CEREAL TILLAGE AND SEEDING**

| Tractor Cost Proportion | Tractor-Implement Combination | Implement Sizes |      |        |        | Total cost |
|-------------------------|-------------------------------|-----------------|------|--------|--------|------------|
|                         |                               | Plow            | Disc | Harrow | Seeder |            |
|                         | — no. —                       | — furrows —     |      | — ft — |        | — \$ —     |
| .1                      | 3                             | 4               | 14   | 16     | 12     | 2,995      |
| .2                      | 3                             | 3               | 12   | 14     | 12     | 3,385      |
| .3                      | 3                             | 3               | 12   | 14     | 12     | 3,727      |
| .4                      | 3                             | 3               | 12   | 14     | 12     | 4,067      |
| .5                      | 3                             | 3               | 12   | 14     | 12     | 4,411      |
| .6                      | 3                             | 3               | 12   | 14     | 12     | 4,752      |

## DISCUSSION

The previous section of this paper demonstrated the effects of changes in several variables on least-cost implement sizes and on costs of cereal tillage and seeding for one situation. Other situations will have quite different least-cost implement sizes and costs. Table 7 illustrates these for some other common cultural practices, with other characteristics of the standard situation remaining as they are shown in the Appendix.

The accuracy of the solutions from the model depends, of course, on the representativeness of the input data. It is perhaps reasonable, therefore, to consider implement sizes that yield costs that lie within 10 percent, for example, of the model's solution for any particular situation.

If in the standard situation, using a three-bottom plow in implement-tractor combination 3, disc, harrow and seeder sizes are allowed to range between 6 and 24 feet in one-foot increments, there are 600 combinations of implement sizes that yield costs lying within 10 percent of the least cost. Figure 6 is a series of graphs showing these implement-size combinations. Points contained in the irregular polygons in Figure 6 represent the harrow and seeder sizes for a 3-furrow plow and the specified disc size whose least costs are within 10 percent of the least-cost size. There are, in addition, 6,259 implement-size combinations (from among these implement-size ranges) that yield costs higher than the least cost plus 10 percent.

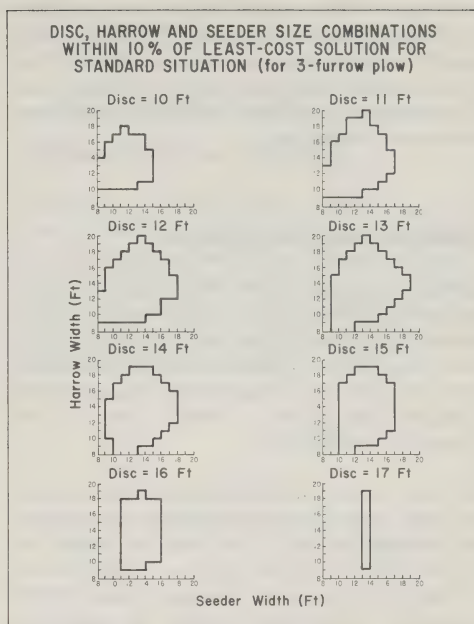


Figure 6

The range of machine sizes appearing in the list of implement-size combinations yielding costs lying within 10 percent of the least cost are 10 to 17, 8 to 20 and 8 to 19 feet for the disc, harrow and seeder, respectively. Not all combinations of implement sizes lying in these ranges, however, yield costs lying within 10 percent of

**TABLE 7. LEAST-COST TRACTOR-IMPLEMENT SIZES AND COSTS FOR VARIOUS CULTURAL PRACTICES IN TILLING AND SEEDING 200 ACRES**

| Cultural Practice <sup>a</sup> | Tractor-Implement Combination | Tractor 1 Size | Tractor 2 Size | Implement Sizes |      |        |        | Total cost |
|--------------------------------|-------------------------------|----------------|----------------|-----------------|------|--------|--------|------------|
|                                |                               |                |                | Plow            | Disc | Harrow | Seeder |            |
|                                | — no. —                       | — hp —         |                | — furrows —     |      | — ft — |        | — \$ —     |
| 1                              | 2                             | 53.3           | 34.8           | 4               | 8    | 0      | 12     | 3,691      |
| 2                              | 2                             | 66.7           | 33.6           | 5               | 8    | 16     | 10     | 4,325      |
| 3                              | 2                             | 53.3           | 34.8           | 4               | 8    | 14     | 12     | 3,935      |
| 4                              | 2                             | 68.4           | 34.8           | 5               | 8    | 18     | 12     | 4,423      |
| 5                              | 2                             | 40.0           | 34.8           | 3               | 8    | 10     | 12     | 3,825      |

<sup>a</sup>Cultural practices are defined as follows:

|                       | Cultural Practice |     |     |                  |                  |
|-----------------------|-------------------|-----|-----|------------------|------------------|
|                       | 1                 | 2   | 3   | 4                | 5                |
| Total acreage plowed  | 200               | 200 | 200 | 200              | 200              |
| Acreage spring plowed | 200               | 200 | 133 | 133              | 0                |
| Acreage disced        | 200               | 200 | 200 | 200              | 200              |
| Acreage harrowed      | 0                 | 200 | 200 | 400 <sup>b</sup> | 400 <sup>b</sup> |
| Acreage seeded        | 200               | 200 | 200 | 200              | 200              |

<sup>b</sup>200 acres harrowed twice

the least cost. In fact, only 600 of the 1,248 possibilities ( $8 \times 13 \times 12$ ) lie within 10 percent of the least cost. It is evident from these figures and from Figure 6 that there is no easy extrapolation from least-cost implement sizes to implement sizes yielding costs that lie within some percentage of the least cost.

## SUMMARY AND CONCLUSION

The least-cost implement-sizes for plowing (half in the fall and half in the spring), discing twice, harrowing and seeding 200 acres of cereal grains are 3-furrow plow, 12-foot disc, 14-foot spring tooth harrow and 12-foot seeder. The total cost of these operations is calculated to be \$4,411. This includes a value for the crop yield reduction due to late seeding.

Ten-percent changes, from the standard situation used in this paper, in the work-day probability and length of time available to work before crop loss begins and machinery prices have more effect on the total cost of the least-cost solutions than 10-percent changes in other factors such as: fuel price, crop-loss rate, labor price, proportion of tractor costs charged to the cereal tillage and seeding, and draft requirements.

There are many implement-size combinations with costs within 10 percent of the least-cost solution for any given acreage and cultural practice. Generalities about the sizes of implements for maximum yield giving costs within 10 percent of the least-cost solution are not possible.

The least-cost implement size combination is specific for each acreage, cultural practice, soil, climate, crop and crop value. For this reason the analysis needs to be done for each farm situation individually.

The availability of an algorithm for determining least-cost implement sizes should help in machinery investment decisions. It should also be useful in choosing least-cost cultural practices in situations where the crop yields that may be expected with each cultural practice are known.

## REFERENCES

1. Agricultural Engineers' Yearbook, American Society of Agricultural Engineers, 1976, p. 327.
2. Baier, W., "Estimation of Field Workdays in Canada from the Versatile Soil Moisture Budget", Can. Agric. Eng., 1973, Vol. 15, No. 2, pp. 84-87.

3. McIsaac, J.A. and Lovering, James, "Calculating Least-Cost Implement Sizes for Tillage and Seeding of Cereals", Canadian Farm Economics, June 1976, Vol. 11, No. 3, pp. 22-26.
4. Nass, H.G., Johnston, H.W., MacLeod, J.A. and Sterling, J.D.E., "Effects of Seeding Date, Seed Treatment and Foliar Sprays on Yield and other Agronomic Characteristics of Wheat, Oats and Barley", Can. J. Plant Sci., 1975, Vol. 55, pp. 41-47.
5. Quarterly Bulletin of Agricultural Statistics, Statistics Canada, Cat. No. 21-003, April-June 1975, pp. 85-92.

## APPENDIX

The standard situation for which least-cost implement sizes have been determined assumes the following:

acreage of spring cereals: 200

cultural practice: plow (half the previous fall), disc twice, harrow (spring tooth) and seed

penalty: \$0.30 per acre per hour\*

working time available before crop loss begins: 75 hours

work-day length: 10 hours

probability of occurrence of days suitable for field work: 0.5

labor price: \$3 per hour\* (labor applies to the hours actually worked)

tractor new cost: \$200 per PTO hp

plow new cost: \$550 per 16" furrow

disc new cost: \$200 per foot of width

harrow new cost: \$47.25 per foot of width

seeder new cost: \$206 per foot of width

fuel price: \$.040 per gallon\*

fuel consumption: 0.06 gallons per horsepower-hour

plow, field efficiency and speed: 80 percent and 4.5 mph

disc, field efficiency and speed: 84 percent and 5 mph

harrow, field efficiency and speed: 72 percent and 6 mph

seeder, field efficiency and speed: 75 percent and 5 mph

plow, PTO hp required per 16" furrow: 13.3

disc, PTO hp required per foot of width: 4.2

harrow, PTO hp required per foot of width: 3.8

\*Based on spring 1976 prices and costs.

seeder, PTO hp required per foot of width: 2.9

interest rate: 10 percent

insurance and shelter rate: 1.5 percent of new cost  
less salvage value per annum

plow (16" furrows) minimum, maximum and increment  
no. of bottoms are: 1, 8 and 1

disc minimum, maximum and increment sizes are: 6,  
24 and 2 ft

harrow minimum, maximum and increment sizes  
are: 6, 24 and 2 ft

seeder minimum, maximum and increment sizes are:  
6, 24 and 2 ft

cereal price (barley): \$3 per bushel

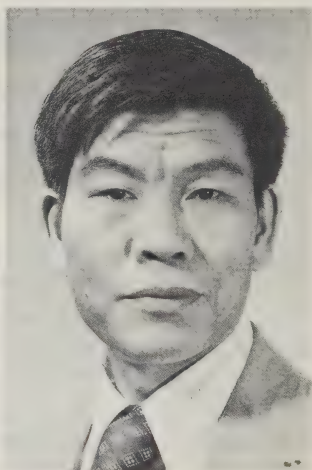
### **Penalty and Work-Day Probability**

Examination of weather records indicates that, on the average, there are about 75 hours available for field work before the optimum planting date. Assuming that barley is valued at \$3 per bushel and that 10 hours are available for field work per day, the penalty is \$0.30 per acre per hour. An acre seeded, for example, four days after the optimum time would incur a penalty of \$12.

# A REGIONAL COMPARISON OF STRUCTURAL CHANGE AND RESOURCE USE IN THE CANADIAN FARM INDUSTRY, 1961 TO 1971



*From 1961 to 1971 the number of farms in Canada decreased while the average farm size (in terms of agriculture sales) and the use of farm resources increased. Rates of change varied by region and farm-size class because of unique socio-economic and institutional forces in each region and class. If such forces continue, a more divergent and regionalized farm structure may be expected.*



Wayne D. Jones and Fu-Lai Tung\*

## INTRODUCTION

The Canadian farm industry is continually adjusting in response to changes in production techniques, input prices, product demand and institutional factors. These alter the agricultural input demand, the resource mix and the optimum farm size<sup>1</sup>. They are expected to persist, making it essential to periodically review structural adjustment trends in order to foresee, and possibly modify, anticipated changes.

This article presents an overview of the structural changes in the Canadian farm industry that occurred between 1961 and 1971 in the areas of farm size, farm numbers and farm resource use. In a subsequent issue of Canadian Farm Economics, the 1971-76 period will be examined to determine if the type and extent of changes differ from those of the previous 10 years.

A regional analysis was required because the combination and magnitude of the forces affecting structural

adjustment tend to be unique to each region, which results in different rates of change. The regions considered are the Atlantic Provinces, Quebec, Ontario, the Prairie Provinces and British Columbia.

## MAJOR ECONOMIC AND INSTITUTIONAL FORCES AFFECTING ADJUSTMENT

Three commonly discussed forces affecting structural change are the cost-price squeeze, increasing productivity, and government policies and programs. Although the exact extent to which each affects farm structure is not known, it is generally agreed that, combined, they have a significant influence on the magnitude and direction of changes.

The cost-price squeeze refers to the situation of farm input prices increasing faster than output prices, thereby reducing the profit margin for a given level of output. This has become more serious in the last 20 years as farmers increased their use of purchased inputs. The result is likely to be a more rapid rate of growth in farm output on large farms while small, marginal farms may be forced to leave the industry<sup>2</sup>.

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<sup>1</sup>Darryl E. Ray and Glenn S. Collins, *Structural Changes in Agriculture*, Bulletin B-720, Agricultural Experiment Station, Oklahoma State University, May 1975, p. 5.

<sup>2</sup>B.J. Powell and I. MacFarlane, The Changing Structure and Economic Situation of the Australian Dairy Industry, *Quarterly Review of Agricultural Economics*, Vol. XXV, No. 4, 1972, p. 256.

The adoption of new technology often results in the substitution of capital for labor and has for the most part greatly improved farm productivity. Innovative farmers adopt new techniques, hoping to reap higher profits before markets adjust to the change. Once markets have adjusted, other farmers risk a loss of income unless they too adopt the new techniques<sup>3</sup>. Some farmers have also shifted from labor-intensive production, where economies of size are mostly limited to gains through labor specialization, to capital-intensive production. As a result, potential economies of size increase substantially as more farm operations are further mechanized and machine capacity increases<sup>4</sup>.

Government programs, such as the Small Farm Development Program and the Prairie Farm Rehabilitation Administration, directly support farm structure adjustment as a means of improving farm efficiency and income. There are many more programs that have an indirect effect on the structure of the farm industry through either the production side (e.g., research, extension work, etc.) or the marketing side (e.g., tariffs, trade agreements, production quotas, etc.). Most government programs focus on particular small sectors of the farm industry where their effects on structural change may be significant.

This article discusses only the structural changes resulting from these and other forces. It does not attempt to analyze how individual factors affect the structural adjustment process.

## DATA SOURCES AND ADJUSTMENTS

The data used in this analytical review were obtained from the 1961, 1966 and 1971 Census of Agriculture, and are presented by region and for Canada as a whole<sup>5</sup>. Within each region the selected statistics are further classified by farm size as measured by the value of agricultural products sold in terms of constant 1961 dollars. Data on the structural variables are provided on both a total and a per farm basis. Institutional farms and farms in the Yukon and Northwest Territories are excluded from the analysis because of their abnormal characteristics<sup>6</sup>.

<sup>3</sup>S.A. Robinson, "Agricultural Structure in England and Wales 1955-1966: A Quantitative Analysis", *The Farm Economist*, Vol. X1, No. 11, 1970, p. 474.

<sup>4</sup>W.R. Butcher and N.K. Whittlesey, "Trends and Problems in Growth of Farm Size", *Journal of Farm Economics*, Vol. 48, No. 5, 1966, p. 1515.

<sup>5</sup>Statistics are available on a provincial basis from the authors.

<sup>6</sup>Institutional farms include experimental farms, land used for agricultural purposes by schools or penitentiaries, and community pastures.

It was necessary to take into account price-change effects before chronological comparisons could be made. A two-stage adjustment procedure was devised to compensate for relative price movements in the 1966 and 1971 census years. The first step was to adjust the number of farms in each economic class for the change in farm commodity prices relative to 1961 under the assumption that farms are uniformly distributed<sup>7</sup>. Data on the structural variables by economic class were then redistributed according to the adjustments in farm numbers. All monetary data presented in the subsequent sections were further adjusted to constant 1961 dollars using the most appropriate price index. An example of the procedure used is presented in the Appendix.

## STRUCTURAL CHANGES

### Farm Numbers

Data in Table 1 indicate the net result of adjustments made in the farm industry from 1961 to 1971. The trend in all regions was toward fewer but larger farms. Farm numbers decreased 24 percent overall, but the rate of change varied widely among regions. At one extreme, the Atlantic Provinces had nearly a 50-percent reduction, whereas in British Columbia the decrease was less than eight percent. The greatest decrease, in absolute terms, occurred in the Prairie region followed by Quebec and then Ontario.

In addition to the sharp decline in farm numbers there was a significant change in the distribution of farms by economic class. Farms in the two smallest farm-size classes accounted for 71 percent of all farms in 1961 compared with only 51 percent in 1971. The number of farms with sales between \$5,000 and \$9,999 was relatively stable while the number of farms with sales greater than \$10,000 increased from about 50,000 to 93,000, or from 10 percent to 25 percent of the total farms. Farms with sales less than \$2,500 continued to be the dominant farm size in all regions except the Prairie Provinces. In this region farms having sales of \$10,000 or more were the most numerous in 1971. Quebec experienced the greatest shift in the distribution of farms by economic class, implying that a major restructuring of its farm industry took place. In contrast,

<sup>7</sup>Note that the adjustment between two economic class sizes depends on the size of the class and, consequently, the results presented in this paper may underestimate the farm numbers in the largest size class. For further information related to the adjustment errors see: R.L. Mighell, "What Do Successive Frequency Distributions Show?" *Agriculture Economics Research*, Vol. 27, Nos. 3 and 4, July-October, 1975, pp. 101-104.

**TABLE 1. NUMBER OF FARMS IN CANADA, BY REGION AND ECONOMIC CLASS IN CONSTANT 1961 DOLLARS, 1961, 1966, & 1971**

| Region and<br>Economic Class | Farm Numbers <sup>a</sup> |         |         | Distribution of Farm Numbers<br>by Economic Class |        |        | Rate of Change<br>(1961=100) by Economic Class |        |        |
|------------------------------|---------------------------|---------|---------|---|--------|--------|--|--------|--------|
|                              | 1961                      | 1966    | 1971    | 1961  | 1966   | 1971   | 1961   | 1966   | 1971   |
|                              | — number —                |         |         | — percentage —                                    |        |        | — percentage —                                 |        |        |
| Canada <sup>b</sup>          |                           |         |         |   |        |        |  |        |        |
| less than \$2,500            | 221,033                   | 165,846 | 117,381 | 46.04   | 38.59  | 32.13  | 100.00   | 75.03  | 53.1   |
| \$2,500 — \$4,999            | 118,775                   | 86,296  | 65,525  | 24.74   | 20.08  | 17.94  | 100.00   | 72.66  | 55.17  |
| \$5,000 — \$9,999            | 90,419                    | 96,499  | 89,521  | 18.83   | 22.46  | 24.50  | 100.00   | 106.72 | 99.01  |
| \$10,000 and over            | 49,841                    | 81,090  | 92,907  | 10.39   | 18.87  | 25.40  | 100.00   | 162.70 | 186.41 |
| Total                        | 480,068                   | 429,731 | 365,334 | 100.00  | 100.00 | 100.00 | 100.00   | 89.51  | 76.10  |
| Atlantic Provinces           |                           |         |         |   |        |        |  |        |        |
| less than \$2,500            | 24,058                    | 17,791  | 9,412   | 72.21   | 67.56  | 55.34  | 100.00   | 73.95  | 39.12  |
| \$2,500 — \$4,999            | 4,726                     | 3,563   | 2,431   | 14.19   | 13.53  | 14.29  | 100.00   | 75.39  | 51.44  |
| \$5,000 — \$9,999            | 2,892                     | 2,851   | 2,544   | 8.68  | 10.83  | 14.96  | 100.00   | 98.58  | 87.97  |
| \$10,000 and over            | 1,638                     | 2,129   | 2,620   | 4.92  | 8.08   | 15.41  | 100.00   | 129.98 | 159.95 |
| Total                        | 33,314                    | 26,334  | 17,007  | 100.00  | 100.00 | 100.00 | 100.00   | 79.05  | 51.05  |
| Quebec                       |                           |         |         |   |        |        |  |        |        |
| less than \$2,500            | 56,655                    | 41,538  | 23,300  | 59.27   | 51.83  | 38.10  | 100.00   | 73.32  | 41.13  |
| \$2,500 — \$4,999            | 23,205                    | 18,725  | 12,120  | 24.28   | 23.36  | 19.82  | 100.00   | 80.69  | 52.23  |
| \$5,000 — \$9,999            | 11,851                    | 13,299  | 14,555  | 12.40   | 16.59  | 23.80  | 100.00   | 112.22 | 122.82 |
| \$10,000 and over            | 3,871                     | 6,584   | 11,179  | 4.05  | 8.22   | 18.28  | 100.00   | 170.09 | 288.79 |
| Total                        | 95,582                    | 80,146  | 61,154  | 100.00  | 100.00 | 100.00 | 100.00   | 83.85  | 63.98  |
| Ontario                      |                           |         |         |   |        |        |  |        |        |
| less than \$2,500            | 51,573                    | 41,951  | 32,513  | 42.54   | 38.20  | 34.36  | 100.00   | 81.34  | 63.04  |
| \$2,500 — \$4,999            | 26,576                    | 19,520  | 14,171  | 21.92   | 17.76  | 14.97  | 100.00   | 73.45  | 53.32  |
| \$5,000 — \$9,999            | 23,901                    | 23,432  | 21,660  | 19.71   | 21.34  | 22.89  | 100.00   | 98.04  | 90.62  |
| \$10,000 and over            | 19,190                    | 24,902  | 26,294  | 15.83   | 22.60  | 27.78  | 100.00   | 129.77 | 137.02 |
| Total                        | 121,240                   | 109,805 | 94,638  | 100.00  | 100.00 | 100.00 | 100.00   | 90.57  | 78.06  |
| Prairie Provinces            |                           |         |         |   |        |        |  |        |        |
| less than \$2,500            | 76,991                    | 53,598  | 41,958  | 36.66   | 27.57  | 24.09  | 100.00   | 69.62  | 54.50  |
| \$2,500 — \$4,999            | 61,407                    | 42,110  | 34,669  | 29.24   | 21.66  | 19.91  | 100.00   | 68.58  | 56.46  |
| \$5,000 — \$9,999            | 49,232                    | 54,440  | 48,235  | 23.44   | 28.01  | 27.69  | 100.00   | 110.58 | 97.97  |
| \$10,000 and over            | 22,396                    | 44,241  | 49,309  | 10.66   | 22.76  | 28.31  | 100.00   | 197.54 | 220.18 |
| Total                        | 210,026                   | 194,389 | 174,171 | 100.00  | 100.00 | 100.00 | 100.00   | 92.55  | 82.93  |
| British Columbia             |                           |         |         |   |        |        |  |        |        |
| less than \$2,500            | 11,756                    | 10,968  | 10,196  | 59.06   | 57.55  | 55.53  | 100.00   | 93.30  | 86.73  |
| \$2,500 — \$4,999            | 2,861                     | 2,378   | 2,134   | 14.37   | 12.48  | 11.62  | 100.00   | 83.11  | 74.62  |
| \$5,000 — \$9,999            | 2,543                     | 2,477   | 2,527   | 12.78   | 13.00  | 13.76  | 100.00   | 97.41  | 99.38  |
| \$10,000 and over            | 2,746                     | 3,234   | 3,505   | 13.79   | 16.97  | 19.09  | 100.00   | 117.77 | 127.66 |
| Total                        | 19,057                    | 19,057  | 18,364  | 100.00  | 100.00 | 100.00 | 100.00   | 95.73  | 92.25  |

<sup>a</sup>Farm numbers shown in the table exclude institutional farms and farms in the Yukon and Northwest Territories.

<sup>b</sup>Farm numbers by economic class in constant 1961 dollars for 1966 and 1971 census years were the adjusted results based on the method described in the text.

Source: Compiled from the Agriculture Census, years 1961, 1966 and 1971.

British Columbia appears to have had a very stable industry during the period with no strong forces acting to change the farm structure in terms of farm numbers.

### Value of Products Sold

Another measure of structural change was the value of products sold variable, as presented in Table 2. The value

of products sold, in constant 1961 dollars, for Canada increased 50 percent from 1961 to 1971 with all regions sharing in the improvement. British Columbia increased its agricultural sales more than 65 percent, the greatest regional gain, followed by the Prairie Provinces (58 percent) and Ontario (43 percent). The increase was lowest for the Atlantic Provinces at 30 percent. The Prairie

**TABLE 2. VALUE OF PRODUCTS SOLD IN CANADA, BY REGION AND ECONOMIC CLASS IN CONSTANT 1961 DOLLARS, 1961, 1966, & 1971.**

| Region and<br>Economic Class           | Value of Products Sold <sup>a</sup> |           |           |                  |      |      |
|--|-------------------------------------|-----------|-----------|------------------|------|------|
|  | Total                               |           |           | Average Per Farm |      |      |
|  | 1961                                | 1966      | 1971      | 1961             | 1966 | 1971 |
| — thousands of constant 1961 dollars — |                                     |           |           |                  |      |      |
| Canada                                 |                                     |           |           |                  |      |      |
| less than \$2,500                      | 231,895                             | 159,730   | 110,526   | 1.0              | 1.0  | 0.9  |
| \$2,500 — \$4,999                      | 428,289                             | 305,530   | 235,300   | 3.6              | 3.5  | 3.6  |
| \$5,000 — \$9,999                      | 625,422                             | 689,533   | 718,429   | 6.9              | 7.1  | 8.0  |
| \$10,000 and over                      | 1,050,686                           | 1,738,663 | 2,443,373 | 21.1             | 21.4 | 26.3 |
| Total                                  | 2,336,292                           | 2,893,456 | 3,507,628 | 4.9              | 6.7  | 9.6  |
| Atlantic Provinces                     |                                     |           |           |                  |      |      |
| less than \$2,500                      | 17,958                              | 12,592    | 7,256     | 0.7              | 0.7  | 0.8  |
| \$2,500 — \$4,999                      | 16,696                              | 12,058    | 8,260     | 3.5              | 3.4  | 3.4  |
| \$5,000 — \$9,999                      | 19,884                              | 19,502    | 22,116    | 6.9              | 6.8  | 8.7  |
| \$10,000 and over                      | 38,467                              | 57,880    | 82,883    | 23.5             | 27.2 | 31.6 |
| Total                                  | 93,005                              | 102,032   | 120,515   | 2.8              | 3.9  | 7.1  |
| Quebec                                 |                                     |           |           |                  |      |      |
| less than \$2,500                      | 58,881                              | 40,692    | 21,312    | 1.0              | 1.0  | 0.9  |
| \$2,500 — \$4,999                      | 81,787                              | 63,886    | 43,067    | 3.5              | 3.4  | 3.6  |
| \$5,000 — \$9,999                      | 79,819                              | 88,303    | 112,284   | 6.7              | 6.6  | 7.7  |
| \$10,000 and over                      | 74,298                              | 132,016   | 238,048   | 19.2             | 20.1 | 21.3 |
| Total                                  | 294,785                             | 324,897   | 414,711   | 3.1              | 4.1  | 6.8  |
| Ontario                                |                                     |           |           |                  |      |      |
| less than \$2,500                      | 51,363                              | 38,025    | 28,058    | 1.0              | 0.9  | 0.9  |
| \$2,500 — \$4,999                      | 96,352                              | 69,236    | 49,946    | 3.6              | 3.5  | 3.5  |
| \$5,000 — \$9,999                      | 167,403                             | 174,486   | 205,710   | 7.0              | 7.4  | 9.5  |
| \$10,000 and over                      | 444,488                             | 615,159   | 800,501   | 23.2             | 24.7 | 30.4 |
| Total                                  | 759,606                             | 896,910   | 1,084,215 | 6.3              | 8.2  | 11.5 |
| Prairie Provinces                      |                                     |           |           |                  |      |      |
| less than \$2,500                      | 95,550                              | 61,403    | 46,982    | 1.2              | 1.1  | 1.1  |
| \$2,500 — \$4,999                      | 223,275                             | 152,218   | 126,821   | 3.6              | 3.6  | 3.7  |
| \$5,000 — \$9,999                      | 340,248                             | 388,479   | 354,904   | 6.9              | 7.1  | 7.4  |
| \$10,000 and over                      | 426,212                             | 844,777   | 1,187,641 | 19.0             | 19.1 | 24.1 |
| Total                                  | 1,085,235                           | 1,446,877 | 1,716,348 | 5.2              | 7.4  | 9.9  |
| British Columbia                       |                                     |           |           |                  |      |      |
| less than \$2,500                      | 8,143                               | 7,014     | 6,918     | 0.7              | 0.6  | 0.7  |
| \$2,500 — \$4,999                      | 10,179                              | 8,132     | 7,206     | 3.6              | 3.4  | 3.4  |
| \$5,000 — \$9,999                      | 18,068                              | 18,763    | 23,415    | 7.1              | 7.6  | 9.3  |
| \$10,000 and over                      | 67,221                              | 88,831    | 134,300   | 24.5             | 27.5 | 31.8 |
| Total                                  | 103,611                             | 122,740   | 171,839   | 5.2              | 6.4  | 9.4  |

<sup>a</sup>Figures shown in the table for 1966 and 1971 census years were the adjusted results based on the procedures presented in the Appendix. The value of products sold by institutional farms and by farms in the Yukon and Northwest Territories was excluded.

Source: Compiled from the Agriculture Census, years 1961, 1966 and 1971.

Provinces continued to be the most important production area, contributing 46 percent and 49 percent of total agricultural sales in Canada, respectively, for 1961 and 1971. On a per-farm basis, Ontario had the highest value of agricultural products sold in each of the three census years and had the greatest rate of change. All

regions had a steady increase in per-farm sales during the period.

Small farms appear to be losing their economic importance. This is evidenced by the reduction in the share of total Canadian agricultural sales from 28 percent in

1961 to 11 percent in 1971 for the two smallest economic classes. The value of agricultural sales for these two groups dropped by \$314 million in constant 1961 dollars. Conversely, farms in the \$10,000-and-over class reached a dominant position in the industry. This class accounted for 70 percent of total agricultural sales in Canada in 1971, well above the 45 percent in 1961. In each region, agricultural sales for the \$10,000-and-over class accounted for more than half the value of products sold. The rate of increase in the share of total value of agricultural sales for the \$10,000-and-over class was highest for the Prairie Provinces, from 40 percent of total sales in 1961 to 70 percent in 1971. British Columbia had the lowest rate with an increase of 13 percent, from 65 percent to 78 percent.

Average agricultural sales per farm indicate a growing difference between small and large farms. Average agricultural sales, for farms in the two smallest size classes, remained remarkably constant over the period in all regions as the decline in value of products sold accompanied the decline in farm numbers. The average value of sales for the class with sales of \$10,000 or more, on the other hand, increased in all regions. The increase was particularly noticeable in the Atlantic Provinces where average sales per farm for the largest size class increased by about \$8,000. The increase was about \$2,000 for Quebec, the lowest regional gain in Canada.

## CHANGES IN RESOURCE USE

### Capital Investment

There has been a marked recombination of resources associated with the regional farm industry structure changes observed during the period. Both investment and production expenses increased substantially.

The capital values, presented in Table 3, are aggregates of the value of farmland and buildings, machinery and equipment, and livestock and poultry<sup>8</sup>. Farm investment increased by \$3 billion from 1961 to 1971 despite the disappearance of 114,734 farms. A \$2.2 billion increase in the value of land and buildings was the major component of this investment and is mainly attributable to increases in the Prairie Provinces and Ontario. The average value of land and buildings per farm increased for each farm-size class and region as farmers acquired more land and buildings to take advantage of economies

of size. The need for higher-capacity machines to work these larger farms created a further \$466 million increase in the value of farm capital.

In all regions and farm-size classes the average value of capital per farm increased. British Columbia had the highest average farm investment for each farm-size class and also the greatest increase in capital value. The Atlantic Provinces had the most rapid overall rate of change although its average value of capital in 1971 was still the lowest in Canada at \$22,100 per farm.

### Agricultural Sales in Relation to Capital Investment

Data in Table 4 show that in all regions the smaller the farm (in terms of sales) the lower the level of sales for a given amount of capital investment. For example, in the Atlantic region in 1961, farms in the \$2,500 - \$4,999 class had average sales of \$22.29 per \$1,000 of capital investment, while farms in the \$10,000-and-over class had sales of \$56.22. Moreover, the gap between small and large farms widened over time. Sales per \$1,000 of investment for the smaller farm class above decreased to \$17.35 in 1971, while sales for the large farm class increased to \$60.65. A final observation is that over the period the sales-investment ratio was generally more favorable in Quebec and the Atlantic Provinces than in the other regions.

### Farmland Acreage

The investment in farmland is indicated by the data on farm area presented in Table 5. Farmland in Canada was composed of about 65 percent improved land and 35 percent unimproved land in 1971 with three quarters of the total located in the Prairie Provinces<sup>9</sup>. The area of farmland in Canada decreased from 167 million acres in 1961 to about 164 million acres in 1971. The reduction is attributable to the decrease in area in Quebec, Ontario and the Atlantic Provinces resulting from a rapid decrease in farm numbers. The Prairie Provinces added seven million acres of improved farmland while British Columbia added 447,000 acres and 770,000 acres respectively, of improved and unimproved farmland. The greatest disappearance of farmland occurred in Quebec, where 3.4 million acres (1.4 million improved acres) went out of agriculture.

<sup>8</sup>Disaggregated data on the three components of farm capital are not included for lack of space but are available from the authors.

<sup>9</sup>Improved land consists primarily of cropland, improved pasture, and summerfallow. Unimproved land consists of woodland, native pasture or hay, and wasteland. Data on these two components of farmland are not included for lack of space but are available from the authors.

**TABLE 3. VALUE OF CAPITAL IN CANADA BY PROVINCE AND ECONOMIC CLASS IN CONSTANT 1961 DOLLARS, 1961, 1966, & 1971**

| Region and<br>Economic Class           | Value of Capital <sup>a</sup> |            |            |                  |      |       |
|--|-------------------------------|------------|------------|------------------|------|-------|
|  | Total                         |            |            | Average Per Farm |      |       |
|  | 1961                          | 1966       | 1971       | 1961             | 1966 | 1971  |
| — thousands of constant 1961 dollars — |                               |            |            |                  |      |       |
| Canada                                 |                               |            |            |                  |      |       |
| less than \$2,500                      | 3,042,952                     | 2,438,171  | 2,250,494  | 13.8             | 14.7 | 19.2  |
| \$2,500 — \$4,999                      | 2,941,960                     | 2,209,988  | 1,935,065  | 24.8             | 25.6 | 29.5  |
| \$5,000 — \$9,999                      | 3,429,181                     | 3,939,459  | 4,324,508  | 37.9             | 40.8 | 48.3  |
| \$10,000 and over                      | 3,643,141                     | 5,691,183  | 7,544,927  | 73.1             | 70.2 | 81.2  |
| Total                                  | 13,057,234                    | 14,278,801 | 16,054,994 | 27.2             | 33.2 | 43.9  |
| Atlantic Provinces                     |                               |            |            |                  |      |       |
| less than \$2,500                      | 197,683                       | 154,433    | 104,435    | 8.2              | 8.7  | 11.1  |
| \$2,500 — \$4,999                      | 74,337                        | 60,104     | 47,479     | 15.7             | 16.9 | 19.6  |
| \$5,000 — \$9,999                      | 64,791                        | 75,319     | 87,197     | 22.4             | 26.4 | 34.2  |
| \$10,000 and over                      | 68,547                        | 91,023     | 136,671    | 41.8             | 42.7 | 52.1  |
| Total                                  | 405,358                       | 380,879    | 375,782    | 12.2             | 14.5 | 22.1  |
| Quebec                                 |                               |            |            |                  |      |       |
| less than \$2,500                      | 664,403                       | 502,991    | 311,855    | 11.7             | 12.1 | 13.4  |
| \$2,500 — \$4,999                      | 461,265                       | 367,597    | 252,139    | 19.9             | 19.6 | 20.8  |
| \$5,000 — \$9,999                      | 320,616                       | 364,111    | 435,854    | 27.1             | 27.4 | 29.9  |
| \$10,000 and over                      | 161,979                       | 267,223    | 473,804    | 41.8             | 40.6 | 42.4  |
| Total                                  | 1,608,263                     | 1,501,922  | 1,473,652  | 16.8             | 18.7 | 24.1  |
| Ontario                                |                               |            |            |                  |      |       |
| less than \$2,500                      | 892,140                       | 771,576    | 791,877    | 17.3             | 18.4 | 24.4  |
| \$2,500 — \$4,999                      | 691,520                       | 540,677    | 474,119    | 26.0             | 27.7 | 33.5  |
| \$5,000 — \$9,999                      | 860,833                       | 964,185    | 1,214,588  | 36.0             | 41.1 | 56.1  |
| \$10,000 and over                      | 1,282,676                     | 1,651,434  | 2,076,406  | 66.8             | 66.3 | 79.0  |
| Total                                  | 3,727,169                     | 3,927,872  | 4,556,990  | 30.7             | 35.8 | 48.2  |
| Prairie Provinces                      |                               |            |            |                  |      |       |
| less than \$2,500                      | 1,071,233                     | 799,430    | 731,314    | 13.9             | 14.9 | 17.4  |
| \$2,500 — \$4,999                      | 1,624,334                     | 1,163,102  | 1,062,644  | 26.4             | 27.6 | 30.6  |
| \$5,000 — \$9,999                      | 2,072,766                     | 2,411,225  | 2,379,167  | 42.1             | 44.3 | 49.3  |
| \$10,000 and over                      | 1,895,245                     | 3,428,976  | 4,419,432  | 84.6             | 77.5 | 89.6  |
| Total                                  | 6,663,578                     | 7,802,733  | 8,592,557  | 31.7             | 40.1 | 49.3  |
| British Columbia                       |                               |            |            |                  |      |       |
| less than \$2,500                      | 217,493                       | 209,741    | 311,013    | 18.5             | 19.1 | 30.5  |
| \$2,500 — \$4,999                      | 90,504                        | 78,508     | 98,684     | 31.6             | 33.0 | 46.2  |
| \$5,000 — \$9,999                      | 110,175                       | 124,619    | 207,702    | 43.3             | 50.3 | 82.2  |
| \$10,000 and over                      | 234,694                       | 252,527    | 438,614    | 85.5             | 78.1 | 125.1 |
| Total                                  | 652,866                       | 665,395    | 1,056,013  | 32.8             | 34.9 | 57.5  |

<sup>a</sup>Figures shown in the table for 1966 and 1971 census years were the adjusted results based on the procedures presented in the Appendix. The value of capital for institutional farms and farms in the Yukon and Northwest Territories was excluded in the table.

Source: Compiled from the Agriculture Census, years 1961, 1966 and 1971.

The average amount of farmland per farm increased in all regions. It appears, however, that the Prairie Provinces had the most extensive farm operations with an average farm area of 735 acres in 1971. This contrasts with the more intensive farming in Quebec where the average farm area was 176 acres. The average per farm in the

Prairie Provinces increased by 140 acres for the period, the largest increase of all the regions.

Average acreage per farm increased over the period for all economic classes in all regions with few exceptions. The average acreage of the two smallest economic classes

**TABLE 4. AVERAGE SALES PER \$1,000 CAPITAL INVESTMENT AND AVERAGE SALES PER ACRE OF FARMLAND PER FARM IN CANADA BY REGION AND ECONOMIC CLASS IN 1961 CONSTANT DOLLARS, 1961, 1966, & 1971**

| Region and<br>Economic Class | Average Sales Per \$1000 of Capital<br>Investment Per Farm <sup>a</sup> |       |       | Average Sales Per Acre of Farmland<br>Per Farm <sup>b</sup> |        |        |
|------------------------------|---|-------|-------|---|--------|--------|
|                              | 1961  | 1966  | 1971  | 1961  | 1966   | 1971   |
| — constant 1961 dollars —    |   |       |       |   |        |        |
| Canada                       |   |       |       |   |        |        |
| less than \$2,500            | 7.25  | 6.80  | 4.69  | 5.34  | 5.48   | 5.01   |
| \$2,500 — \$4,999            | 14.52   | 13.67 | 12.20 | 10.41   | 10.67  | 10.50  |
| \$5,000 — \$9,999            | 18.21   | 17.40 | 16.56 | 13.98   | 14.56  | 15.94  |
| \$10,000 and over            | 28.86   | 30.48 | 32.39 | 26.04   | 27.68  | 32.43  |
| Total                        | 18.01   | 20.18 | 21.87 | 14.04   | 17.11  | 21.41  |
| Atlantic Provinces           |   |       |       |   |        |        |
| less than \$2,500            | 8.54  | 8.05  | 7.21  | 5.19  | 5.11   | 5.76   |
| \$2,500 — \$4,999            | 22.29   | 10.12 | 17.35 | 17.12   | 15.96  | 15.54  |
| \$5,000 — \$9,999            | 30.80   | 25.76 | 25.44 | 29.47   | 26.21  | 31.44  |
| \$10,000 and over            | 56.22   | 63.70 | 60.65 | 75.63   | 85.67  | 91.78  |
| Total                        | 22.95   | 26.90 | 32.13 | 17.25   | 22.27  | 35.04  |
| Quebec                       |   |       |       |   |        |        |
| less than \$2,500            | 8.55  | 8.26  | 6.72  | 7.72  | 7.30   | 6.53   |
| \$2,500 — \$4,999            | 17.59   | 17.35 | 17.31 | 20.91   | 19.52  | 19.94  |
| \$5,000 — \$9,999            | 24.72   | 24.09 | 25.75 | 37.49   | 34.67  | 38.35  |
| \$10,000 and over            | 45.93   | 49.51 | 50.24 | 95.76   | 98.53  | 97.93  |
| Total                        | 18.45   | 21.93 | 28.22 | 20.99   | 25.62  | 38.66  |
| Ontario                      |   |       |       |   |        |        |
| less than \$2,500            | 5.78  | 4.89  | 3.69  | 8.29  | 7.53   | 8.21   |
| \$2,500 — \$4,999            | 13.85   | 12.64 | 10.45 | 22.57   | 21.55  | 22.57  |
| \$5,000 — \$9,999            | 19.44   | 18.00 | 16.93 | 39.61   | 40.42  | 48.82  |
| \$10,000 and over            | 34.73   | 37.25 | 38.48 | 115.48  | 115.80 | 134.45 |
| Total                        | 20.52   | 22.91 | 23.86 | 41.20   | 50.62  | 68.37  |
| Prairie Provinces            |   |       |       |   |        |        |
| less than \$2,500            | 8.63  | 7.38  | 6.32  | 3.97  | 3.73   | 3.90   |
| \$2,500 — \$4,999            | 13.64   | 13.04 | 12.09 | 7.06  | 7.42   | 7.57   |
| \$5,000 — \$9,999            | 16.39   | 16.03 | 15.01 | 9.20  | 10.06  | 9.97   |
| \$10,000 and over            | 22.46   | 24.65 | 26.90 | 12.74   | 15.90  | 18.73  |
| Total                        | 16.40   | 18.45 | 20.08 | 8.74  | 11.25  | 13.47  |
| British Columbia             |   |       |       |   |        |        |
| less than \$2,500            | 3.76  | 3.14  | 2.30  | 6.32  | 5.11   | 6.03   |
| \$2,500 — \$4,999            | 11.39   | 9.19  | 7.36  | 15.19   | 11.86  | 11.76  |
| \$5,000 — \$9,999            | 16.40   | 15.11 | 11.31 | 27.82   | 17.50  | 18.32  |
| \$10,000 and over            | 28.65   | 35.21 | 25.42 | 36.42   | 40.13  | 42.70  |
| Total                        | 15.85   | 18.34 | 16.35 | 23.12   | 23.19  | 30.31  |

<sup>a</sup>Computed by dividing average sales per farm (Table 2) by average value of capital per farm (Table 3).

<sup>b</sup>Computed by dividing average sales per farm (Table 2) by average acres of land per farm (Table 5).

of farms in Ontario decreased slightly, which may have been in part due to the increasing number of small, part-time and hobby farms. A decreasing acreage per farm for each economic class in the Prairie Provinces could have been partially due to the abnormal circumstances surrounding the period from 1969 to early 1971. These included a grain surplus, low grain prices, the LIFT Program (Lower Inventory for Tomorrow) and a lower vol-

ume of sales which all affected the classification of farms by economic class.

### Agricultural Sales in Relation to Land Use

Relating the value of sales by economic class to land use shows that small farms required more land for a given output than large farms. This is similar to the

**TABLE 5. TOTAL FARMLAND IN CANADA, BY PROVINCE AND ECONOMIC CLASS IN CONSTANT 1961 DOLLARS, 1961, 1966, & 1971**

| Region and<br>Economic Class | Farm Area <sup>a</sup> |                    |         |                  |           |        |
|------------------------------|------------------------|--------------------|---------|------------------|-----------|--------|
|                              | Total                  |                    |         | Average Per Farm |           |        |
|                              | 1961                   | 1966               | 1971    | 1961             | 1966      | 1971   |
|                              |                        | — thousand acres — |         |                  | — acres — |        |
| <b>Canada</b>                |                        |                    |         |                  |           |        |
| less than \$2,500            | 41,401                 | 30,245             | 21,042  | 187.3            | 182.4     | 179.7  |
| \$2,500 — \$4,999            | 41,086                 | 28,302             | 22,472  | 345.9            | 328.0     | 343.0  |
| \$5,000 — \$9,999            | 44,613                 | 47,060             | 44,913  | 493.4            | 487.7     | 501.7  |
| \$10,000 and over            | 40,389                 | 62,686             | 75,336  | 810.4            | 773.0     | 810.9  |
| Total                        | 167,494                | 168,293            | 103,813 | 348.9            | 391.6     | 448.4  |
| <b>Atlantic Provinces</b>    |                        |                    |         |                  |           |        |
| less than \$2,500            | 3,249                  | 2,436              | 1,307   | 135.0            | 136.9     | 138.9  |
| \$2,500 — \$4,999            | 971                    | 759                | 532     | 205.4            | 213.0     | 218.8  |
| \$5,000 — \$9,999            | 677                    | 740                | 704     | 234.1            | 259.4     | 276.7  |
| \$10,000 and over            | 509                    | 676                | 902     | 310.7            | 317.5     | 344.3  |
| Total                        | 5,406                  | 4,611              | 3,445   | 162.3            | 175.1     | 202.6  |
| <b>Quebec</b>                |                        |                    |         |                  |           |        |
| less than \$2,500            | 7,344                  | 5,686              | 3,212   | 129.6            | 136.9     | 137.9  |
| \$2,500 — \$4,999            | 3,884                  | 3,261              | 2,188   | 167.4            | 174.2     | 180.5  |
| \$5,000 — \$9,999            | 2,118                  | 2,582              | 2,923   | 178.7            | 190.4     | 200.8  |
| \$10,000 and over            | 776                    | 1,343              | 2,432   | 200.5            | 204.0     | 217.5  |
| Total                        | 14,122                 | 12,822             | 10,755  | 147.7            | 160.0     | 175.9  |
| <b>Ontario</b>               |                        |                    |         |                  |           |        |
| less than \$2,500            | 6,219                  | 5,012              | 3,562   | 120.6            | 119.5     | 109.6  |
| \$2,500 — \$4,999            | 4,238                  | 3,170              | 2,198   | 159.5            | 162.4     | 155.1  |
| \$5,000 — \$9,999            | 4,224                  | 4,290              | 4,214   | 176.7            | 183.1     | 194.6  |
| \$10,000 and over            | 3,856                  | 5,311              | 5,944   | 200.9            | 213.3     | 226.1  |
| Total                        | 18,537                 | 17,783             | 15,918  | 152.9            | 162.0     | 168.2  |
| <b>Prairie Provinces</b>     |                        |                    |         |                  |           |        |
| less than \$2,500            | 23,286                 | 15,825             | 11,827  | 302.4            | 295.3     | 281.9  |
| \$2,500 — \$4,999            | 31,315                 | 20,430             | 16,937  | 510.0            | 485.2     | 488.5  |
| \$5,000 — \$9,999            | 36,945                 | 38,422             | 35,789  | 750.4            | 705.8     | 742.0  |
| \$10,000 and over            | 33,401                 | 53,140             | 63,448  | 1491.4           | 1201.1    | 1286.7 |
| Total                        | 124,947                | 127,817            | 128,001 | 594.9            | 657.5     | 734.9  |
| <b>British Columbia</b>      |                        |                    |         |                  |           |        |
| less than \$2,500            | 1,303                  | 1,286              | 1,184   | 110.8            | 117.3     | 116.1  |
| \$2,500 — \$4,999            | 678                    | 682                | 617     | 237.0            | 286.7     | 289.1  |
| \$5,000 — \$9,999            | 649                    | 1,076              | 1,283   | 255.2            | 434.4     | 507.5  |
| \$10,000 and over            | 1,847                  | 2,216              | 2,610   | 672.6            | 685.3     | 744.7  |
| Total                        | 4,477                  | 5,260              | 5,694   | 224.9            | 276.0     | 310.1  |

<sup>a</sup>Figures shown in the 1966 and 1971 census years were adjusted results based on the procedure presented in the Appendix. Farmland occupied by institutional farms and farms in the Yukon and Northwest Territories was excluded in the table.

Source: Compiled from the Agriculture Census, years 1961, 1966 and 1971.

relationship between farm sales and capital investment for all regions (Table 4). The implication is that large farms were more efficiently utilizing the land, assuming the quality of land used by the two groups was similar. The average sales per acre of farmland were highest in Ontario, followed by Quebec and then the Atlantic Provinces. However, the sales level in Ontario was achieved with a much higher use of purchased inputs

than in other regions (Table 6). The Prairie Provinces had the lowest average sales per acre at \$13.47 in 1971. All regions experienced increases in average sale per acre during the period.

### Operating Expenses

On a per-acre basis in 1971, Ontario farms had the highest operating expenses at about \$50. Quebec farms

had \$34 followed by the Atlantic Provinces with \$27. Farms in the Prairie Provinces had the lowest at \$7.

Expenditures on each input, after adjustments for price movements, increased during the period, in most cases. This indicates that Canadian farmers increased the volume of purchased inputs. The most significant increases were for machinery, fertilizer and lime, feed and interest, with each increasing by more than \$100 per farm in all five regions. Other crop expenses, such as herbicides and irrigation equipment, also increased noticeably, particularly in Ontario and Quebec.

The data in Table 6 also indicate that total operating expenses per farm increased significantly in all regions

from 1961 to 1971. In Quebec and the Atlantic Provinces operating expenses per farm more than doubled. In Ontario and British Columbia they increased about 65 percent, and were the highest in Canada. Those in the Prairie Provinces increased about 60 percent, yet this region had the lowest operating expenses.

The relative importance of individual inputs varied among regions, but feed costs were the major expense in every region except the Prairie Provinces, where machinery expenses led. The variation in the relative importance of specific purchased inputs to total operating expenses between 1961 and 1971 was generally less than five percent. Interest, in relation to total operating

**TABLE 6. AVERAGE PER FARM OPERATING EXPENSES IN CANADA, BY REGION IN CONSTANT 1961 DOLLARS 1961, 1966, AND 1971**

| Region                    | Year | Taxes <sup>b</sup> | Gross Farm Rent | Wages to Farm Labor | Inter-est on Indebtedness <sup>c</sup> | Total Machinery Expenses <sup>d,e</sup> | Ferti-lizer and Lime | Other Crop Expenses <sup>f</sup> | Feed <sup>g</sup> | Other Livestock Expenses <sup>h</sup> | Repairs to Buildings | Hydro and Phone | Misci. | Total Operating Expenses |
|---------------------------|------|--------------------|-----------------|---------------------|--|---|----------------------|----------------------------------|-------------------|---------------------------------------|----------------------|-----------------|--------|--------------------------|
| — constant 1961 dollars — |      |                    |                 |                     |  |   |                      |                                  |                   |                                       |                      |                 |        |                          |
| Canada <sup>a</sup>       | 1961 | 258                | 168             | 480                 | 225                                    | 807                                     | 166                  | 177                              | 687               | 109                                   | 147                  | 70              | 249    | 3,544                    |
|                           | 1966 | 288                | 180             | 437                 | 368                                    | 1,096                                   | 375                  | 268                              | 1,005             | 185                                   | 224                  | 110             | 362    | 4,898                    |
|                           | 1971 | 338                | 192             | 471                 | 415                                    | 1,457                                   | 448                  | 392                              | 1,385             | 203                                   | 218                  | 122             | 448    | 6,089                    |
| Maritime Provinces        | 1961 | 144                | 14              | 437                 | 100                                    | 439                                     | 286                  | 142                              | 557               | 34                                    | 160                  | 44              | 123    | 2,481                    |
|                           | 1966 | 162                | 22              | 461                 | 183                                    | 590                                     | 488                  | 227                              | 1,022             | 63                                    | 239                  | 80              | 179    | 3,710                    |
|                           | 1971 | 166                | 52              | 636                 | 270                                    | 1,088                                   | 563                  | 415                              | 1,753             | 90                                    | 173                  | 82              | 274    | 5,562                    |
| Quebec                    | 1961 | 153                | 21              | 288                 | 178                                    | 432                                     | 161                  | 122                              | 1,019             | 41                                    | 192                  | 63              | 259    | 2,930                    |
|                           | 1966 | 176                | 31              | 270                 | 314                                    | 609                                     | 272                  | 255                              | 1,490             | 87                                    | 292                  | 110             | 388    | 4,294                    |
|                           | 1971 | 248                | 56              | 341                 | 375                                    | 963                                     | 415                  | 418                              | 2,094             | 117                                   | 267                  | 118             | 555    | 5,967                    |
| Ontario                   | 1961 | 300                | 164             | 815                 | 223                                    | 729                                     | 292                  | 230                              | 1,239             | 303                                   | 214                  | 93              | 400    | 5,003                    |
|                           | 1966 | 317                | 185             | 690                 | 358                                    | 976                                     | 523                  | 442                              | 1,655             | 521                                   | 304                  | 128             | 560    | 6,659                    |
|                           | 1971 | 332                | 213             | 757                 | 364                                    | 1,343                                   | 656                  | 680                              | 2,251             | 558                                   | 306                  | 139             | 707    | 8,306                    |
| Prairie Provinces         | 1961 | 304                | 266             | 347                 | 267                                    | 1,103                                   | 78                   | 173                              | 170               | 45                                    | 87                   | 62              | 175    | 3,077                    |
|                           | 1966 | 340                | 270             | 330                 | 424                                    | 1,455                                   | 326                  | 194                              | 324               | 71                                    | 145                  | 105             | 267    | 4,251                    |
|                           | 1971 | 388                | 252             | 305                 | 483                                    | 1,744                                   | 340                  | 247                              | 500               | 81                                    | 168                  | 122             | 302    | 4,932                    |
| British Columbia          | 1961 | 196                | 115             | 842                 | 218                                    | 547                                     | 164                  | 219                              | 1,387             | 61                                    | 136                  | 77              | 272    | 4,236                    |
|                           | 1966 | 236                | 75              | 748                 | 336                                    | 789                                     | 285                  | 237                              | 2,157             | 108                                   | 260                  | 105             | 368    | 5,704                    |
|                           | 1971 | 311                | 122             | 895                 | 323                                    | 1,219                                   | 345                  | 328                              | 2,748             | 84                                    | 148                  | 136             | 419    | 7,079                    |

<sup>a</sup>Excludes Newfoundland.

<sup>b</sup>Owned land and buildings only.

<sup>c</sup>Mortgage payments on owned land and buildings, together with interest payments on all other farm business debts.

<sup>d</sup>For the farm business.

<sup>e</sup>Tires, anti-freeze, licences, insurance, etc.

<sup>f</sup>Pesticides, nursery stock, irrigation, containers, seed and twine.

<sup>g</sup>Purchases through commercial channels only.

<sup>h</sup>Livestock purchases, artificial insemination charges, purebred livestock registration fees and veterinary expenses.

<sup>i</sup>Fencing, custom work, insurance, and other supplies and services not previously mentioned.

Note: Individual operating expenses were deflated by Statistics Canada's Farm Input Price Index sub-indexes.

Source: Agriculture Canada, Selected Agricultural Statistics for Canada, Publication No. 76/10, Ottawa, 1976.

expenses, had the highest growth rate in Ontario, Quebec and the Prairie Provinces. Machinery and feed expenses had the highest growth rate in British Columbia and the Atlantic Provinces, respectively.

### Off-farm Work

Changes in production techniques, farm product markets,

government programs and institutional factors, in addition to influencing the use of capital and land, also increased the incidence of part-time farming or off-farm work. The growth in off-farm work reflected the need to supplement low farm income, as well as the reduction in labor-intensive tasks which released farm operators for other employment. The data in Table 7

**TABLE 7. OFF-FARM WORK OF FARM OPERATORS IN CANADA, BY PROVINCE AND ECONOMIC CLASS IN CONSTANT 1961 DOLLARS 1961, 1966, & 1971**

| Region and<br>Economic Class | Total  |                   |        | Average Per Farm |          |       |
|------------------------------|--------|-------------------|--------|------------------|----------|-------|
|                              | 1961   | 1966              | 1971   | 1961             | 1966     | 1971  |
| Canada                       |        | — thousand days — |        |                  | — days — |       |
| less than \$2,500            | 16,936 | 14,894            | 11,481 | 76.6             | 89.8     | 96.8  |
| \$2,500 — \$4,999            | 3,428  | 3,917             | 3,680  | 28.9             | 45.4     | 55.7  |
| \$5,000 — \$9,999            | 1,559  | 2,681             | 2,939  | 17.2             | 27.7     | 33.1  |
| \$10,000 and over            | 737    | 1,494             | 1,836  | 14.8             | 18.5     | 20.3  |
| Total                        | 22,660 | 22,986            | 19,936 | 47.2             | 53.5     | 54.6  |
| Atlantic Provinces           |        |                   |        |                  |          |       |
| less than \$2,500            | 2,167  | 1,601             | 994    | 90.1             | 90.0     | 93.9  |
| \$2,500 — \$4,999            | 172    | 166               | 130    | 36.4             | 46.7     | 53.6  |
| \$5,000 — \$9,999            | 76     | 92                | 81     | 26.3             | 32.2     | 31.8  |
| \$10,000 and over            | 39     | 49                | 49     | 23.8             | 23.0     | 18.7  |
| Total                        | 2,454  | 1,908             | 1,144  | 73.7             | 72.5     | 67.2  |
| Quebec                       |        |                   |        |                  |          |       |
| less than \$2,500            | 4,015  | 3,428             | 1,762  | 70.9             | 82.5     | 75.6  |
| \$2,500 — \$4,999            | 593    | 830               | 506    | 25.6             | 44.3     | 41.7  |
| \$5,000 — \$9,999            | 184    | 372               | 362    | 15.5             | 27.9     | 24.8  |
| \$10,000 and over            | 63     | 133               | 189    | 16.3             | 20.3     | 16.9  |
| Total                        | 4,855  | 4,763             | 2,819  | 50.8             | 59.4     | 46.1  |
| Ontario                      |        |                   |        |                  |          |       |
| less than \$2,500            | 5,065  | 4,661             | 3,977  | 98.2             | 111.1    | 122.3 |
| \$2,500 — \$4,999            | 1,112  | 1,262             | 1,223  | 41.8             | 64.6     | 86.3  |
| \$5,000 — \$9,999            | 553    | 895               | 1,038  | 23.1             | 38.2     | 47.9  |
| \$10,000 and over            | 335    | 608               | 743    | 17.5             | 24.4     | 28.2  |
| Total                        | 7,065  | 7,426             | 6,981  | 58.3             | 67.6     | 73.8  |
| Prairie Provinces            |        |                   |        |                  |          |       |
| less than \$2,500            | 4,227  | 3,826             | 3,543  | 54.9             | 71.4     | 84.4  |
| \$2,500 — \$4,999            | 1,356  | 1,477             | 1,630  | 22.1             | 35.1     | 47.0  |
| \$5,000 — \$9,999            | 657    | 1,200             | 1,327  | 13.3             | 22.0     | 27.5  |
| \$10,000 and over            | 245    | 618               | 758    | 10.9             | 14.0     | 15.4  |
| Total                        | 6,485  | 7,121             | 7,258  | 30.9             | 36.6     | 41.7  |
| British Columbia             |        |                   |        |                  |          |       |
| less than \$2,500            | 1,458  | 1,378             | 1,315  | 124.0            | 125.7    | 129.0 |
| \$2,500 — \$4,999            | 196    | 182               | 191    | 68.5             | 76.7     | 89.6  |
| \$5,000 — \$9,999            | 89     | 122               | 131    | 35.0             | 49.4     | 51.8  |
| \$10,000 and over            | 55     | 86                | 97     | 20.0             | 26.5     | 27.7  |
| Total                        | 1,798  | 1,768             | 1,734  | 90.3             | 92.8     | 94.4  |

<sup>a</sup>Figures in the 1966 and 1971 years were adjusted based on the procedures presented in the Appendix. Days of off-farm work by institutional farm operators and by farm operators in the Yukon and Northwest Territories were excluded.

Source: Compiled from the Agriculture Census years 1961, 1966, and 1971.

indicate the extent of change in labor inputs<sup>10</sup>. In general, the number of days of off-farm work increased with each successive census year, with some exceptions in Quebec and the Atlantic Provinces. These exceptions may be attributable to lack of employment opportunities outside farming in the early 1970s. The Prairie Provinces had the lowest average level of off-farm work at about 42 days per farm in 1971, which could be due to the high proportion of large farms with very few days of off-farm work and to a lack of off-farm employment opportunities. The highest average was in British Columbia at 94 days, followed by Ontario at 74 days. By economic class, the smaller the farm operation, the greater the reliance on off-farm employment.

## SUMMARY

This analysis of census data from 1961 to 1971 was initiated to increase our knowledge of Canada's changing farm industry structure and its impact on resource use. It was observed that farm numbers declined while the average farm size and use of resources increased. Of more importance is the evidence of unequal rates of change among regions and farm-size classes.

The Atlantic Provinces had the greatest reduction in farm numbers at 50 percent, while British Columbia had the smallest at only eight percent. All regions had an increase in the constant dollar value of products sold.

The Prairie Provinces continued to lead the farm industry in total sales although Ontario had the highest value of sales per farm.

A rapid change in the use of resources occurred in all regions, but the pattern of change varied. The Atlantic Provinces had the greatest increase in value of capital per farm, but British Columbia had the greatest increase in acreage per farm. The Prairie Provinces had the greatest increase in days of off-farm work per farm, while Quebec had the greatest decrease in days of off-farm work per farm. Ontario farms had the highest average operating expenses of any region in 1961, 1966 and 1971.

As the number of small farms decreased in relation to the total number of farms in Canada, so did the proportion of total sales attributable to small farms. There appeared to be a disproportionate relationship between resource use and sales on small farms, when compared to large farms, indicating the presence of economies of size on the large farms. In general, off-farm work by farm operators increased for all farm-size classes, but the rate of increase was higher for the smaller size classes.

The reasons for differences in resource combination and growth rates among regions and farm-size classes have yet to be identified, but these differences are expected to continue and may result in a more diverse and more regionalized farm industry structure. Such differences will likely become an increasingly important factor in the classification of farms into sub-groups that would properly reflect their characteristics for policy objectives and programs. It would be valuable to re-investigate changes in farm industry structure and resource use once the 1976 Agricultural Census data become available so that a more recent picture of the magnitude and direction of changes could be obtained.

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<sup>10</sup> Off-farm work was calculated on a "per-farm" basis for regional comparisons and to keep the series of tables consistent. However, the magnitude of the adjustments would be considerably larger if off-farm work was reported on a "per operator reporting off-farm work" basis.

## APPENDIX

### Examples of the Adjustment Procedure: Ontario 1971

#### A. Adjustment of Farm Numbers by Economic Class in Constant 1961 Dollars

| Economic Class<br>(Value of Products Sold) | 1971<br>Unadjusted<br>Farm<br>Numbers | 1970 Farm Product<br>Price Index<br>(June 1960-May 1961=100) | 1971<br>Economic Class<br>Adjustment | 1971 Adjusted Farm Numbers        |
|--|---------------------------------------|--|--------------------------------------|-----------------------------------|
| <\$2,500                                   | 28,971                                | —  | —                                    | $28,971 + 3,542 = 32,513$         |
| \$2,500 – \$4,999                          | 13,316                                | 126.6  | $13,316 \times .266 = 3,542$         | $13,316 - 3,542 + 4,397 = 14,171$ |
| \$5,000 – \$9,999                          | 16,527                                | 126.6  | $16,527 \times .266 = 4,397$         | $16,527 - 4,397 + 9,530 = 21,660$ |
| \$10,000 +                                 | 35,824                                | 126.6  | $35,824 \times .266 = 9,530$         | $35,824 - 9,530 = 26,294$         |
| TOTAL                                      | 94,638                                | —  | —                                    | 94,638                            |

#### B. Adjustment of Value of Products Sold by Economic Class in Constant 1961 Dollars

| Adjustment<br>Procedure  | Economic Class |                      |                      |                      | Total     |
|--|----------------|----------------------|----------------------|----------------------|-----------|
|  | <\$2,500       | \$2,500 –<br>\$4,999 | \$5,000 –<br>\$9,999 | \$10,000<br>and over |           |
| 1. 1971 unadjusted value of products sold (\$'000)   | 25,497         | 48,413               | 119,450              | 1,179,256            | 1,372,616 |
| 2. Average value of products sold by these farms<br>adjusted out from the class (\$) <sup>a</sup>      |                | 2,830                | 5,650                | 17,400               |           |
| 3. Total value of products sold by these farms<br>adjusted out from the class (\$'000) <sup>b</sup>    |                | -10,024              | -24,843              | -165,822             |           |
| 4. Total value of products sold by these farms<br>adjusted into the class (\$'000)                     | +10,024        | +24,843              | +165,822             |                      |           |
| 5. Adjusted total value of products sold in<br>current dollars (\$'000) (1 – 3 + 4)                    | 35,521         | 63,232               | 260,429              | 1,013,434            | 1,372,616 |
| 6. Adjusted total value of products sold in<br>constant 1961 dollars (\$'000) (5 ÷ 1.266) <sup>c</sup> | 28,058         | 49,946               | 205,710              | 800,501              | 1,084,215 |

<sup>a</sup>The average value of products sold for farms that were adjusted out was determined by changes in the Farm Product Price Index. If the Farm Product Price Index was 126.6 for 1970, it implies that about 27 percent of farms in the \$2,500 – \$4,999 class would be classified in the less than \$2,500 class if there was no increase in farm product prices. The mean value of \$2,500 and \$3,165 ( $\$2,500 + \$25 \times 26.6$ ), which is \$2,830, was assumed to be the average value of products sold for farms that were adjusted out. The same procedure was used to determine the average value of products sold for farms adjusted out for each class except the largest class. For this class, the unadjusted average value of products sold was employed to determine the upper limit before the procedure was applied.

<sup>b</sup>This step simply multiplies the determined average value of products sold, obtained from step 2, by the number of farms adjusted out (obtained from the procedure presented in A).

<sup>c</sup>The figure of 1.266 is the 1970 Farm Product Price Index.

#### C. Adjustment of Other Structural Variables by Economic Class in Constant 1961 Dollars

1. The procedures employed to adjust farm resources, capital, land and off-farm work were the same as those employed to adjust the value of products sold except the average value of the variable for each economic class was employed as the estimate in determining the total value of that variable associated with farms that were adjusted out.
2. The Farm Input Price Index was used to deflate the value of capital.

# NOTE: HIGHLIGHTS OF CANADA'S 1976 AGRICULTURAL TRADE

## HIGHLIGHTS OF CANADA'S AGRICULTURAL TRADE IN 1976

*We present the following summary of Canada's agricultural trade because of its importance to the economy. The information is taken from the Economics Branch Publication "Canada's Trade in Agricultural Products 1974, 1975 and 1976", by D.L. Bolton, Publication No. 77/11. In the December issue of Canadian Farm Economics we plan to publish an article on trade with Japan, our largest single export market for farm products.*

Canada's agricultural trade again showed a surplus in 1976. The value of exports increased slightly from \$3.94 billion in 1975 to \$3.96 billion. Imports rose from \$2.9 billion to \$3.13 billion, leaving a surplus of about \$800 million. The surplus was lower than in 1975, reversing the upward trend in the trade balance that had occurred in the 1972-75 period.

The increased value of imports was mainly due to higher unit values, particularly for coffee and coffee products, as well as increased imports of beef, veal, pork, fruit and vegetables. Canada was on a net import basis for fresh pork in 1976 and continued to be a net importer of beef and veal.

Our major export markets continued to be in the European Economic Community (EEC), Japan, the United States and the U.S.S.R., with 66 percent of exports absorbed by these countries. Exports to the EEC totaled \$890 million (1975 - \$818 million), 22.5 percent of the total. Canada realized an agricultural trade surplus with the EEC in 1976 of \$672 million.

Agricultural exports to Japan were valued at \$778 million, 7.3 percent above 1975. This represents a continuation in the upward trend in agricultural exports to Japan, now Canada's most important single-country market. It represented 19.7 percent of Canada's agricultural export trade in 1976.

The United States, the next most important market, taking 14.5 percent of our agricultural exports, increased its purchases from \$498 million to \$574 million (15 percent).

Exports to the U.S.S.R. and the People's Republic of China, consisting mostly of grains, were \$361 million and \$144 million respectively.

Seventy-two percent of our imports are from the United States, the EEC and Australia. Our dependence on the U.S. market for imports is shown by the continuing upward trend in its share of our import market. In 1976 Canada imported over \$1.8 billion of agricultural products from that country, an increase of 14.8 percent from 1975.

## Exports

In 1976 the value of grain exports decreased to \$2.37 billion from \$2.5 billion in 1975. On a volume basis, shipments of wheat and rye decreased while those of barley, oats and corn increased.

Wheat exports in 1976 were 4.6 percent below the year-earlier level at 387.7 million bushels. Given the lower world prices for wheat, export earnings at \$1.7 billion were 14.6 percent below the year-earlier total.

Barley exports at 199 million bushels were 28 percent above the previous year and the value of \$542 million was an all-time record.

There was an increased quantity of oilseed exports in 1976. The value was \$282 million, down 16 percent from the \$336 million of 1975 because of lower prices for rapeseed and flaxseed.

Live animal exports increased to \$119.8 million (\$70.5 million in 1975) largely because of increased shipments of feeder and slaughter cattle to the United States, following the normalization of Canada - U.S. beef and cattle trade. Meat exports increased by \$43 million to \$206 million.

Dairy product exports increased to \$60.6 million from \$40.2 million because of larger shipments of skim milk powder.

Vegetable and potato exports increased by \$33 million to \$115 million mainly because of increased potato shipments to the EEC following the drought and poor crop season in Western Europe.

## Imports

Grain imports were valued at \$121.5 million, down 8.3 percent from 1975. Imports of corn, the major part of

**TOTAL EXPORTS AND EXPORTS OF AGRICULTURAL PRODUCTS BY MAJOR GROUPINGS – AVERAGE  
1967-71 – CALENDAR YEARS 1972-76**

| Commodity                   | Average<br>1967-71 | 1972       | 1973                | 1974                | 1975                 | 1976                 |
|-----------------------------|--------------------|------------|---------------------|---------------------|----------------------|----------------------|
| — thousand dollars —        |                    |            |                     |                     |                      |                      |
| All Commodities             | 14,544,619         | 19,660,668 | 24,837,920          | 31,674,495          | 32,325,043           | 37,258,769           |
| Agricultural Products       | 1,553,800          | 2,135,386  | 3,004,513           | 3,860,403           | 3,939,729            | 3,959,948            |
| Grains <sup>a</sup>         | 793,477            | 1,158,174  | 1,521,658           | 2,407,420           | 2,503,744            | 2,365,285            |
| Wheat                       | 682,119            | 916,545    | 1,218,966           | 2,063,875           | 2,000,510            | 1,707,623            |
| Barley                      | 94,364             | 216,926    | 278,570             | 324,506             | 440,436              | 542,362              |
| Grain products (human)      | 86,596             | 84,862     | 107,786             | 142,865             | 196,225              | 201,046              |
| Wheat flour                 | 57,865             | 45,029     | 48,053              | 60,030              | 103,760              | 122,479              |
| Animal feeds <sup>b</sup>   | 46,954             | 63,058     | 80,023              | 79,270              | 77,181               | 108,419              |
| Oilseeds                    | 130,624            | 212,852    | 369,373             | 380,483             | 335,890              | 282,559              |
| Flaxseed                    | 50,908             | 68,511     | 112,985             | 148,631             | 83,816               | 66,278               |
| Rapeseed                    | 66,236             | 125,446    | 230,151             | 199,844             | 223,550              | 185,971              |
| Oilseed products            | 26,777             | 30,330     | 43,860              | 44,891              | 34,014               | 47,915               |
| Oilcake and meal            | 15,670             | 13,686     | 26,194              | 20,849              | 11,589               | 18,310               |
| Animals, live               | 50,326             | 77,245     | 132,505             | 78,114              | 70,492               | 119,805              |
| Cattle                      | 45,826             | 67,222     | 118,326             | 58,534              | 62,925               | 109,021              |
| Meats                       | 83,801             | 130,316    | 200,049             | 140,055             | 163,599              | 206,562              |
| Beef, veal, fresh, frozen   | 31,993             | 39,421     | 64,958 <sup>c</sup> | 34,151 <sup>c</sup> | 21,426 <sup>c</sup>  | 64,796 <sup>c</sup>  |
| Pork, fresh, frozen         | 27,850             | 58,315     | 99,887 <sup>c</sup> | 73,533 <sup>c</sup> | 104,260 <sup>c</sup> | 103,702 <sup>c</sup> |
| Other animal products       | 89,363             | 111,935    | 160,164             | 171,181             | 157,744              | 204,066              |
| furs, hides and skins       | 51,704             | 70,548     | 98,997              | 87,295              | 85,033               | 124,209              |
| Dairy products              | 44,726             | 48,790     | 89,781              | 66,731              | 40,245               | 60,642               |
| Cheese                      | 15,349             | 14,561     | 8,469               | 6,953               | 5,200                | 5,597                |
| Skim milk powder            | 23,348             | 30,888     | 78,075              | 55,517              | 32,361               | 44,798               |
| Poultry and eggs            | 8,018              | 7,869      | 17,141              | 24,171              | 19,227               | 15,288               |
| Fruit and nuts              | 26,269             | 22,533     | 34,617              | 30,722              | 30,477               | 30,727               |
| Apples, fresh               | 12,297             | 8,441      | 14,709              | 10,712              | 11,280               | 13,258               |
| Vegetables (excl. potatoes) | 35,091             | 38,009     | 58,592              | 58,050              | 56,942               | 69,819               |
| Potatoes and products       | 13,665             | 10,513     | 14,878              | 23,484              | 25,382               | 45,540               |
| Seeds for sowing            | 14,814             | 16,777     | 22,056              | 26,862              | 19,166               | 20,819               |
| Maple products              | 6,516              | 7,150      | 7,352               | 6,531               | 5,813                | 7,844                |
| Sugar                       | 2,299              | 3,262      | 13,645              | 22,390              | 48,583               | 17,116               |
| Tobacco, raw                | 53,567             | 53,224     | 57,152              | 71,424              | 69,116               | 62,899               |
| Tobacco, bright flue-cured  | 52,936             | 52,409     | 54,346              | 65,166              | 64,135               | 58,495               |
| Vegetable fibres            | 1,188              | 1,593      | 2,637               | 4,017               | 4,702                | 5,456                |
| Plantation crops            | 2,757              | 3,302      | 5,956               | 7,132               | 3,868                | 10,193               |
| Other agricultural products | 36,972             | 53,592     | 65,298              | 74,610              | 77,319               | 77,908               |
| Peat and other moss         | 14,896             | 17,811     | 19,189              | 26,442              | 26,561               | 30,697               |

<sup>a</sup>Excludes seed wheat and seed oats (included in Seeds for Sowing).

<sup>b</sup>Excludes oilcake and meal (see Oilseed Products).

<sup>c</sup>Includes fancy meats (offals) (beef — \$8,455; pork — \$10,258 thousand) 1973;  
(beef — \$5,320; pork — \$10,862 thousand) 1974;  
(beef — \$5,074; pork — \$10,549 thousand) 1975;  
(beef — \$7,273; pork — \$10,295 thousand) 1976.

**TOTAL IMPORTS AND IMPORTS OF AGRICULTURAL PRODUCTS BY MAJOR GROUPINGS – AVERAGE  
1967-71 – CALENDAR YEARS 1972-76**

| Commodity                               | Average<br>1967-71 | 1972       | 1973                | 1974                | 1975                | 1976       |
|---|--------------------|------------|---------------------|---------------------|---------------------|------------|
| – thousand dollars –                    |                    |            |                     |                     |                     |            |
| All Commodities                         | 13,439,540         | 18,669,426 | 23,325,320          | 31,692,121          | 34,635,513          | 37,432,617 |
| Agricultural Products                   | 1,201,389          | 1,539,366  | 2,162,980           | 2,829,209           | 2,891,679           | 3,129,254  |
| Grains                                  | 45,027             | 38,422     | 87,952              | 181,721             | 132,408             | 121,483    |
| Corn                                    | 32,467             | 25,047     | 65,805              | 151,219             | 102,671             | 95,053     |
| Grain products (human)                  | 22,019             | 26,005     | 36,639              | 61,040              | 49,702              | 57,229     |
| Bakery products                         | 10,453             | 13,228     | 14,351              | 18,960              | 22,531              | 28,899     |
| Animal feeds <sup>a</sup>               | 8,402              | 16,411     | 29,015              | 29,520              | 35,073              | 33,674     |
| Oilseeds                                | 59,899             | 55,415     | 78,734              | 131,278             | 131,706             | 126,164    |
| Soybeans                                | 50,575             | 39,108     | 50,360              | 90,504              | 86,210              | 81,136     |
| Oilseed products                        | 68,605             | 80,871     | 118,226             | 199,318             | 181,170             | 190,472    |
| Oils                                    | 43,406             | 51,567     | 66,991              | 132,241             | 114,025             | 109,807    |
| Oilcake and meal                        | 23,008             | 26,375     | 46,915              | 51,455              | 54,599              | 70,248     |
| Animals, live                           | 18,869             | 37,670     | 128,320             | 99,507              | 61,251              | 88,865     |
| Cattle                                  | 12,745             | 30,075     | 114,880             | 83,954              | 43,302              | 70,461     |
| Meats                                   | 92,493             | 153,484    | 223,828             | 186,601             | 192,439             | 335,393    |
| Beef, veal, fresh, frozen,              | 40,069             | 88,795     | 133,574             | 97,494              | 72,295              | 132,510    |
| Pork, fresh, frozen                     | 11,080             | 14,097     | 25,473              | 38,035              | 77,031              | 144,561    |
| Mutton, lamb, fresh, frozen,            | 17,443             | 21,497     | 29,506              | 20,935              | 16,474              | 18,842     |
| Other animal products                   | 83,244             | 101,487    | 131,392             | 148,920             | 144,592             | 186,227    |
| Hides, skins, furs                      | 33,893             | 52,753     | 68,743              | 76,358              | 73,699              | 101,120    |
| Wool, raw                               | 24,306             | 20,790     | 30,397              | 26,667              | 24,505              | 30,021     |
| Dairy products                          | 20,687             | 33,832     | 65,526 <sup>b</sup> | 78,598 <sup>b</sup> | 58,323 <sup>b</sup> | 56,724     |
| Cheese                                  | 17,099             | 25,915     | 30,291              | 41,375              | 47,561              | 52,243     |
| Poultry and eggs                        | 15,389             | 15,010     | 19,154              | 24,590              | 32,670              | 59,916     |
| Shell eggs <sup>c</sup>                 | 7,084              | 6,096      | 7,760               | 9,817               | 12,098              | 17,386     |
| Fruits and nuts                         | 260,438            | 322,756    | 400,596             | 434,171             | 490,954             | 546,209    |
| Citrus, fresh or processed              | 90,839             | 94,693     | 108,321             | 111,944             | 132,001             | 142,221    |
| Bananas                                 | 34,669             | 35,466     | 37,736              | 41,515              | 54,326              | 59,134     |
| Vegetables (excl. potatoes)             | 114,234            | 151,087    | 193,084             | 237,867             | 265,936             | 289,273    |
| Fresh vegetables                        | 83,351             | 106,074    | 133,401             | 142,174             | 177,085             | 207,456    |
| Potatoes and products                   | 8,825              | 9,729      | 19,721              | 25,356              | 19,185              | 29,219     |
| Seeds for sowing                        | 9,265              | 11,409     | 16,444              | 22,346              | 22,252              | 23,741     |
| Sugar                                   | 71,567             | 133,291    | 167,942             | 441,979             | 504,962             | 274,175    |
| Tobacco, raw                            | 5,058              | 3,843      | 8,856               | 9,873               | 11,590              | 7,690      |
| Vegetable fibres                        | 58,345             | 61,228     | 74,863              | 77,563              | 57,286              | 76,346     |
| Cotton, raw                             | 47,908             | 52,353     | 65,181              | 66,349              | 48,984              | 69,033     |
| Plantation crops                        | 158,854            | 173,919    | 224,044             | 258,317             | 292,611             | 405,996    |
| Coffee and products                     | 87,564             | 100,138    | 123,999             | 131,685             | 168,430             | 250,693    |
| Tea and products                        | 22,962             | 25,083     | 25,291              | 29,822              | 35,094              | 35,869     |
| Other agricultural products             | 80,169             | 113,497    | 138,644             | 180,644             | 207,569             | 219,458    |
| Spices, flavorings<br>and confectionery | 24,230             | 40,401     | 51,022              | 62,074              | 81,791              | 78,540     |

<sup>a</sup>Excludes oilcake and meal (see Oilseed Products).

<sup>b</sup>Includes (62,635,000 pounds of butter valued at \$31,446,000) 1973:  
(53,765,900 pounds of butter valued at \$31,237,000) 1974;  
(10,063,900 pounds of butter valued at \$ 5,897,000) 1975.

<sup>c</sup>Includes hatching eggs.

grain imports, were 6.5 percent below year-earlier levels on a volume basis.

Oilseed imports at \$126.2 million were 4.3 percent below the 1975 value. Imports of soybeans showed a decrease at \$81.1 million compared with \$86.2 million in 1975. Oilseed product import values advanced 5.1 percent to \$190.5 million.

A general increase in imports of meat and animal products occurred in 1976. Meat imports moved sharply higher because of increased quantities of both beef and pork. Beef and veal imports were 209.6 million pounds, up 63 percent from 1975 levels. Significant quantities of beef were imported from Australia, New Zealand and the United States, with Australia remaining the major source. Pork imports more than doubled, to 182.3 million pounds, and as a result Canada's pork trade showed a deficit for the first time since 1969.

The value of imports of mutton and lamb increased to \$18.8 million from \$16.5 million.

Fruit and nuts was the most important group of agricultural commodities imported in 1976. The value increased 11.3 percent to \$546 million, the major suppliers being the United States and Mexico.

The value of sugar imports fell from \$504.9 million to \$274.2 million. Canada imported 1.98 billion pounds of raw and refined sugar compared with 2.19 billion pounds in 1975, a reduction of 9.5 percent.

With adverse weather in the major coffee-producing regions reducing world output, coffee prices increased significantly in 1976. Our coffee imports were valued at \$250.7 million for 198 million pounds compared with \$168.4 million for 210 million pounds in 1975.

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## PUBLICATIONS

### ECONOMICS BRANCH, AGRICULTURE CANADA

*Available from the Publications Manager, Room 303, Sir John Carling Building, Ottawa, Ontario, K1A 0C5.*

**Canada's Trade in Agricultural Products, 1974, 1975 and 1976.** D.L. Bolton. Publication No. 77/11. 55 p. Mostly tables.

**Handbook of Food Expenditures, Prices and Consumption.** Z.A. Hassan and D.T. Karamchandani. Mostly tables. Bilingual.

### ECONOMICS BRANCH, ONTARIO MINISTRY OF AGRICULTURE AND FOOD

*Available from O.M.A.F., Legislative Buildings, Queen's Park, Toronto, Ontario, M7A 1B6.*

**Agricultural Statistics for Ontario 1976.** 55 p. Paper cover. Mostly tables. Wide variety of statistics.

**Late-Potato Production Costs and Returns in Ontario, 1975.** R.G.F. Hill. April 1977. 22 p.

**The Dairy Processing Industry in Ontario.** Roy McCulloch and Bruce Carbert. August 1976. 29 p.

**White Bean Production Costs and Returns in Southern and Western Ontario, 1975.** March 1977. 25 p.

**The Ontario Automatic Cropping Budget System for Cash Grain Farms — A Tool for Detailed Farm Management.** W.C. Pfeiffer (School of Agricultural Economics and Extension Education, University of Guelph). November 1976. 31 p.

**A Selected List of Branch Publications, January 1977.** Gives the names of publications available at above date, under headings: Co-operatives; Dairy; Land Use; Production (Field Crops); Production (Fruit and Vegetables); Livestock; General; Marketing; Statistics.

### INTERNATIONAL DEVELOPMENT RESEARCH CENTRE

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*Note: This Centre was established in 1970 by an act of the Canadian Parliament "to initiate, encourage, support and conduct research into the problems of the developing regions of the world and into the means for applying and adapting scientific, technical and other knowledge to the economic and social advancement of those regions". It has concentrated its efforts on trying to*

*improve the well-being of rural peoples; its agricultural projects are being directed mostly to the poorest of regions, the semi-arid tropics.*

**Development at a Crossroads: Present Problems, Future Prospects.** W. David Hopper, President, IDRC. Publication No. IDRC-090e. 18 p. Based on a lecture given on January 12, 1977 in Tokyo, Japan.

**Canada's Role in World Agricultural Development.** W. David Hopper. Publication No. IDRC-085e. 16 p. Presented as the J.S. McLean Lecture at the University of Guelph, November 1976.

**Interface — IDRC Review 1975-76.** Publication No. IDRC-037e. 31 p.

## MISCELLANEOUS

**Economic Characteristics of Country Livestock Auctions in Manitoba.** N.J. Beaton, and F. Mbeve. January 1977. 38 p. Paper cover. Tables and figures.

*Write: Department of Agricultural Economics, University of Manitoba, 403 Agriculture Building, Winnipeg, Manitoba.*

**Farm Credit Corporation Annual Report, 1976-77.** Ottawa, 1977. 32 p. Paper cover, bilingual. Illustrations, tables, financial statement. *Write; FCC, 6309 Postal Station "J", Ottawa, K2A 3W9.*

**National Farm Products Marketing Council Annual Report, 1976-77.** Ottawa, 1977. 60 p. Paper cover, bilingual. Tables, figures, *Write the Council at 165 Sparks St., 7th Floor, Ottawa, K1P 5B9.*

**IN REPLY TO AUTHORS AND EDITORS REGARDING OCTOBER 1977**  
**CANADIAN FARM ECONOMICS**

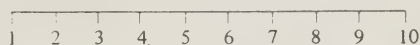
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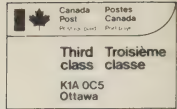


# CONVERSION FACTORS FOR METRIC SYSTEM

| Imperial units         | Approximate<br>conversion factor     | Results in:                          |
|------------------------|--------------------------------------|--------------------------------------|
| <b>LINEAR</b>          |                                      |                                      |
| inch                   | x 25                                 | millimetre (mm)                      |
| foot                   | x 30                                 | centimetre (cm)                      |
| yard                   | x 0.9                                | metre (m)                            |
| mile                   | x 1.6                                | kilometre (km)                       |
| <b>AREA</b>            |                                      |                                      |
| square inch            | x 6.5                                | square centimetre (cm <sup>2</sup> ) |
| square foot            | x 0.09                               | square metre (m <sup>2</sup> )       |
| acre                   | x 0.40                               | hectare (ha)                         |
| <b>VOLUME</b>          |                                      |                                      |
| cubic inch             | x 16                                 | cubic centimetre (cm <sup>3</sup> )  |
| cubic foot             | x 28                                 | cubic decimetre (dm <sup>3</sup> )   |
| cubic yard             | x 0.8                                | cubic metre (m <sup>3</sup> )        |
| fluid ounce            | x 28                                 | millilitre (ml)                      |
| pint                   | x 0.57                               | litre (ℓ)                            |
| quart                  | x 1.1                                | litre (ℓ)                            |
| gallon                 | x 4.5                                | litre (ℓ)                            |
| <b>WEIGHT</b>          |                                      |                                      |
| ounce                  | x 28                                 | gram (g)                             |
| pound                  | x 0.45                               | kilogram (kg)                        |
| short ton (2000 lb)    | x 0.9                                | tonne (t)                            |
| <b>TEMPERATURE</b>     |                                      |                                      |
| degrees Fahrenheit     | (° F-32) x 0.56<br>or (° F-32) x 5/9 | degrees Celsius (° C)                |
| <b>PRESSURE</b>        |                                      |                                      |
| pounds per square inch | x 6.9                                | kilopascal (kPa)                     |
| <b>POWER</b>           |                                      |                                      |
| horsepower             | x 746<br>x 0.75                      | watt (W)<br>kilowatt (kW)            |
| <b>SPEED</b>           |                                      |                                      |
| feet per second        | x 0.30                               | metres per second (m/s)              |
| miles per hour         | x 1.6                                | kilometres per hour (km/h)           |
| <b>AGRICULTURE</b>     |                                      |                                      |
| gallons per acre       | x 11.23                              | litres per hectare (ℓ/ha)            |
| quarts per acre        | x 2.8                                | litres per hectare (ℓ/ha)            |
| pints per acre         | x 1.4                                | litres per hectare (ℓ/ha)            |
| fluid ounces per acre  | x 70                                 | millilitres per hectare (ml/ha)      |
| tons per acre          | x 2.24                               | tonnes per hectare (t/ha)            |
| pounds per acre        | x 1.12                               | kilograms per hectare (kg/ha)        |
| ounces per acre        | x 70                                 | grams per hectare (g/ha)             |
| plants per acre        | x 2.47                               | plants per hectare (plants/ha)       |

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# CANADIAN FARM ECONOMICS



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Agriculture  
Canada

HON. EUGENE WHELAN, MINISTER — GAÉTAN LUSSIER, DEPUTY MINISTER

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# JAPAN — CANADA'S LEADING AGRICULTURAL EXPORT MARKET



C. Smith-Wright\*

## INTRODUCTION

The dominant feature of Japan's agriculture is its limited land resources in relation to the country's population. Even the large growth in agricultural productivity during the last decade has been unable to fully compensate for this. The problem has been accentuated by the faster productivity growth in the non-agricultural sector. This has put more demands on the agricultural sector at a time when its contribution to the net national product has been falling and its share of the labor force rapidly declining.

Consequently, Japan will likely continue to be a major food importer. This is particularly significant against the background of Japan's rising standard of living which has been associated with a trend away from the traditional high starch diet to one with more protein. Related to Japan's reliance on food imports is a concern for security of supply, which was heightened by the sharp increase in oil prices and the 1973 soybean embargo. Hence Japan has increased its agricultural production where possible while aiming to maintain secure and stable supplies of imported farm products.

\*Until recently, C. Smith-Wright was an economist with the Trade Policy Section of the Economics Branch of Agriculture Canada, Ottawa.

*In 1976, Japan was Canada's major single country market for agricultural products. Canada should be able to retain its share of trade in those commodities already imported by Japan, while increasing exports of other products such as tobacco, apples and processed foods. To achieve this, Canada must remain competitive with other suppliers and become more familiar with Japan's requirements and marketing system.*

The policy objectives of Canada and Japan for agricultural trade are complementary to some extent. Japan is seeking stable supplies of farm products and Canada is aiming at a "continuing supply and increasing production of those food products in which Canada has a competitive advantage for export to commercial markets. . ."<sup>1</sup> It is therefore not surprising that Japan has been Canada's major single country market for exports of agricultural products since 1974.

Such general statements and aggregate figures, however, shed little light on the varying importance of market and supplier, policy implications and the potential for various commodities. Hence it is useful to briefly review the policy tools and the sectors Japan is concentrating on to meet its objectives of increased production and stable supplies.

## JAPAN'S AGRICULTURAL POLICY

The main objectives of Japan's agricultural policy in the immediate post-war period were to secure a stable food supply and to modernize the rural communities through land reform (by the Food Control Act of 1942 and the

<sup>1</sup>Throne Speech, February 27, 1976

Agricultural Land Act of 1952). As Japan entered a period of high economic growth in the mid-1950s, however, the disparity in productivity and income between the agricultural and other sectors widened. As a result, there was an increased flow of labor out of agriculture and changes in the pattern of food consumption and demand occurred. In response to these changes, Japan enacted the Agricultural Basic Law in 1961.

This law prescribes the following objectives: "... agriculture productivity should increase in such a way as to reduce the disparity in productivity between agriculture and other industries and that those engaged in agriculture should earn higher incomes enabling them to make a living comparable to those engaged in other industries."

Policy measures to meet these objectives included the following:

- to increase production of certain agricultural products, improve productivity and increase gross agricultural output;

- to improve agricultural structure by expanding farms, etc.;

- to stabilize prices of agricultural products and maintain present levels of income;

- to reform the marketing and processing of agricultural products as well as the agricultural infrastructure;

- to train farmers and encourage their families to seek employment in other industries and

- to promote farmers' welfare by improving living conditions in rural areas.

New factors emerged in the 1960s, namely the over-production of rice, rising food prices, increased competition from food imports and regional and environmental problems. This prompted the Japanese government to release a document in February 1975 entitled "Promotion of Comprehensive Agricultural Policy", outlining the following revised policy guidelines:

- to create as many large-scale and highly efficient farms as possible and encourage the development of "production organization" including part-time farmers so that the scope of the unit of operation is enlarged,

- to control rice production and change the pattern of production to meet changing demand patterns,

- to stabilize prices of agricultural products to fully reflect long-run market balances and rationalization of distribution and processing,

- to ensure comparability of income and living standards with those of other sectors,

- to encourage and aid the smooth flow of farmers out of agriculture and

- to establish vigorous and pleasant rural communities, while conserving the natural environment and recreational opportunities.

Thus like most countries, Japan's agricultural policies have both economic and social objectives.

## AGRICULTURAL SELF-SUFFICIENCY

The present situation in relation to self-sufficiency in various agricultural commodities is shown in Table 1.

**TABLE 1. AGRICULTURAL PRODUCTION AND IMPORTS, SELECTED COMMODITIES, JAPAN, 1976**

| Commodity     | Production | Imports      |             |
|---------------|------------|--------------|-------------|
|               |            | Total        | From Canada |
|               |            | — 000 tons — |             |
| Wheat         | 242        | 6,423        | 1,673       |
| Barley        | 220        | 1,942        | 1,062       |
| Pork          | 1,164      | 164          | 29          |
| Beef and veal | 328        | 101          | 2           |
| Soybeans      | 121        | 3,917        | 9           |
| Rapeseed      | 7          | 791          | 757         |
| Alfalfa meal  | n.a.       | 549          | 130         |
| Cattle hides  | n.a.       | 310          | 6           |
| Tallow        | n.a.       | 258          | 18          |

Source: Ministry of Agriculture and Forestry, Japan Customs Bureau

The significance for Canada can be seen by comparing Japan's general policy objectives with self-sufficiency, present and projected for various commodities. The most striking feature is the decline since 1960 in self-sufficiency for grains other than rice, most particularly wheat and barley. At the same time, however, Japan has maintained a fairly high level of self-sufficiency in livestock products and predicts that pork and poultry will reach 99 and 100 percent respectively by 1985. Nevertheless, consumption continues to exceed production, particularly for pork. These projections underline the importance of secure supplies of imported feed grains. In the case of beef, which is not as suitable for land-intensive production as pork and poultry, Japan expects to import almost one fifth of its requirements. Another significant sector of agricultural trade is oils and fats, in which the degree of self-sufficiency is expected to decline from 23 percent in 1972 to only 17 percent in 1985.

**TABLE 2. VALUE OF CANADA'S AGRICULTURAL EXPORTS TO JAPAN, 1967-76**

|  | 1967-71<br>Average | 1972 | 1973 | 1974 | 1975 | 1976 |
|--|--------------------|------|------|------|------|------|
| Value of agricultural exports<br>(\$million) | 185                | 275  | 539  | 686  | 729  | 779  |
| As a percentage of:                          |                    |      |      |      |      |      |
| Total Canadian agricultural<br>exports (%)   | 11.9               | 12.9 | 17.9 | 17.8 | 18.6 | 19.7 |
| Total exports to Japan (%)                   | 27.0               | 28.5 | 29.8 | 30.8 | 34.4 | 32.6 |

Source: Canada's Trade in Agricultural Products, 1974, 1975 and 1976, Economics Branch, Publication No. 77/11, July 1977

## CANADA'S AGRICULTURAL EXPORTS TO JAPAN

The value of Canada's agricultural exports to Japan increased from \$275 million in 1972 to nearly \$780 million in 1976, about one third of all Canadian exports

to Japan (Table 2). As a result, Japan has become Canada's leading single market for farm products, in 1976 taking 20 percent. This share was only slightly smaller than that of the nine-country European Economic Community (EEC). See Figure 1. The commodity breakdown of farm exports to Japan is shown in Table 3.

**TABLE 3. VALUE OF CANADA'S TOTAL EXPORTS AND EXPORTS OF AGRICULTURAL PRODUCTS TO JAPAN, AVERAGE 1967-71 AND CALENDAR YEARS 1972-76**

| Commodity                           | Average<br>1967-71 | 1972    | 1973      | 1974      | 1975      | 1976      |
|-------------------------------------|--------------------|---------|-----------|-----------|-----------|-----------|
| — \$000 —                           |                    |         |           |           |           |           |
| All Commodities                     | 685,121            | 961,027 | 1,806,979 | 2,227,050 | 2,117,266 | 2,387,942 |
| Agricultural Products               | 185,012            | 274,703 | 538,776   | 686,108   | 729,024   | 778,509   |
| Wheat                               | 87,624             | 86,715  | 173,051   | 308,181   | 250,780   | 281,539   |
| Barley                              | 17,039             | 35,654  | 91,666    | 89,774    | 125,452   | 131,092   |
| Rye                                 | 4,367              | 7,280   | 10,675    | 2,536     | 6,123     | 4,805     |
| Buckwheat                           | 1,736              | 2,604   | 2,453     | 2,102     | 2,129     | 2,442     |
| Soybeans                            | —                  | —       | 1,282     | 1,280     | 988       | 1,806     |
| Rapeseed                            | 34,163             | 69,540  | 134,392   | 160,512   | 193,587   | 166,675   |
| Flaxseed                            | 14,494             | 12,498  | 23,633    | 30,819    | 23,470    | 25,053    |
| Mustard seed                        | 1,248              | 914     | 1,042     | 1,935     | 2,983     | 3,174     |
| Rapeseed oil                        | —                  | —       | 4,601     | 2,425     | 1,744     | 3,723     |
| Animal feeds                        | 7,052              | 8,400   | 15,189    | 19,654    | 17,236    | 31,283    |
| Hides, skins and<br>furs            | 2,854              | 4,189   | 5,410     | 4,304     | 4,192     | 6,402     |
| Milk powder                         | 646                | 1,934   | 1,352     | 117       | 500       | 3,114     |
| Honey                               | 394                | 554     | 3,234     | 101       | 74        | 331       |
| Live animals<br>(including poultry) | 829                | 319     | 718       | 1,334     | 606       | 2,182     |
| Beef and veal (fresh<br>or frozen)  | 27                 | 37      | 2,170     | 762       | 1,765     | 2,952     |
| Pork (fresh or<br>frozen)           | 3,522              | 29,005  | 45,560    | 27,671    | 68,284    | 75,530    |
| Horse meat                          | 21                 | 36      | 425       | 291       | 1,534     | 1,738     |
| Tallow                              | 3,783              | 3,720   | 5,577     | 6,624     | 3,601     | 6,129     |
| Gelatin, edible                     | 8                  | 104     | 695       | 1,242     | 622       | 1,218     |
| Malt                                | 2,704              | 6,905   | 9,774     | 16,884    | 17,490    | 19,620    |
| Tobacco, raw                        | —                  | —       | 372       | 702       | 1,805     | 1,878     |
| Other agricultural<br>products      | 2,501              | 4,295   | 5,505     | 6,858     | 4,049     | 5,826     |

Source: Canada's Trade in Agricultural Products, 1974, 1975 and 1976, Economics Branch, Publication No. 77/11, July 1977

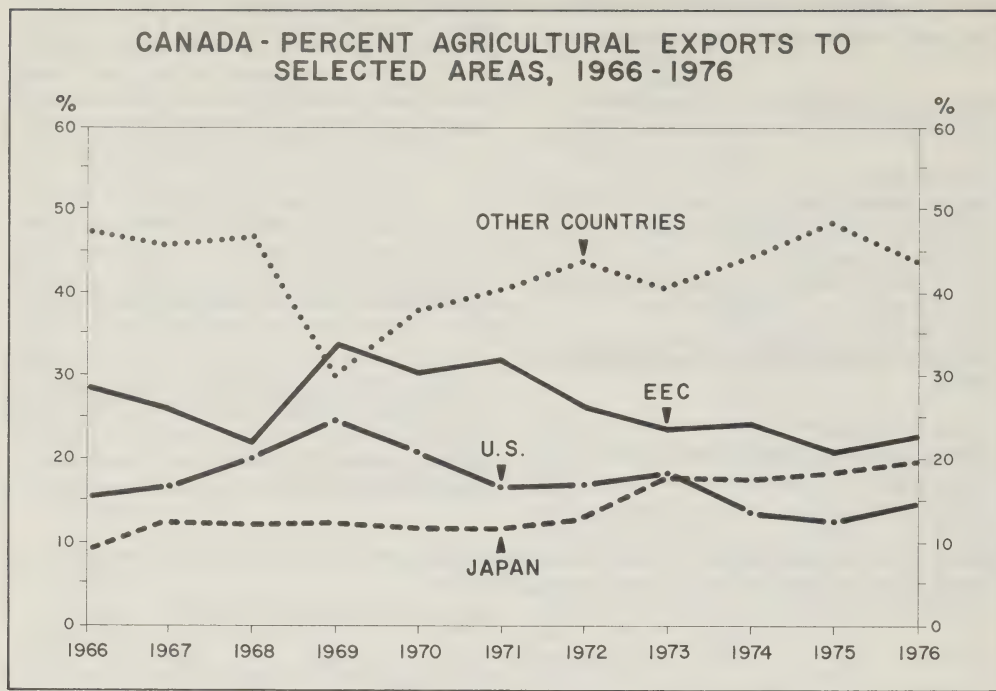


Figure 1

The increase in value of agricultural exports to Japan in 1972-76 largely reflects the higher level of commodity prices, particularly for grains and oilseeds. Nevertheless, there has been an increase in export volumes, particularly for barley, rapeseed and pork (Table 4). This strength of agricultural exports to Japan has been an important factor in agriculture's significant contribution to Canada's balance of payments in recent years (Figure 2). The positive trade balance in agricultural products with Japan was about \$760 million in 1976.

Although Japan should continue to be the most important market for Canadian agricultural exports, it is unlikely that the rapid increase in the value of exports will be sustained in the next few years. Whereas some increase in volume is forecast, the sharp price increases that occurred after 1972 might not be repeated (although a crop shortfall in any major producing area could soon lead to a tight supply situation and sharply higher prices). Because of the sharply lower world prices for grains since the end of 1976, however, the value of exports of wheat and barley to Japan in 1977 will decrease significantly. Also influencing the level of farm exports are signs of a slowdown in the growth of demand for food, according to the 1976 White Paper on

Japanese Agriculture. This reflects the slower rate of economic growth expected in the next few years and the fact that individual food consumption and nutritional levels have reached a fairly high plane. Structural changes in the pattern of food imports, therefore, will be less marked than in the past.

TABLE 4. VOLUME OF CANADA'S EXPORTS OF PRINCIPAL AGRICULTURAL COMMODITIES TO JAPAN, 1974-76

| Commodity                          | 1974   | 1975   | 1976   | % Increase<br>1976-75 |
|------------------------------------|--------|--------|--------|-----------------------|
| — 000 bu —                         |        |        |        |                       |
| Wheat                              | 54,326 | 47,348 | 56,385 | 19.1                  |
| Barley                             | 29,690 | 43,303 | 46,163 | 6.6                   |
| Rapeseed                           | 21,779 | 25,546 | 30,286 | 18.6                  |
| Flaxseed                           | 3,032  | 2,572  | 3,568  | 38.7                  |
| Pork, fresh or<br>frozen ('000 lb) | 29,670 | 54,465 | 59,906 | 10.0                  |

Source: Canada's Trade in Agricultural Products, 1974, 1975, 1976, Economics Branch, Publication No. 77/11, July 1977

## CANADA - MERCHANDISE TRADE BALANCE, 1966 - 1976

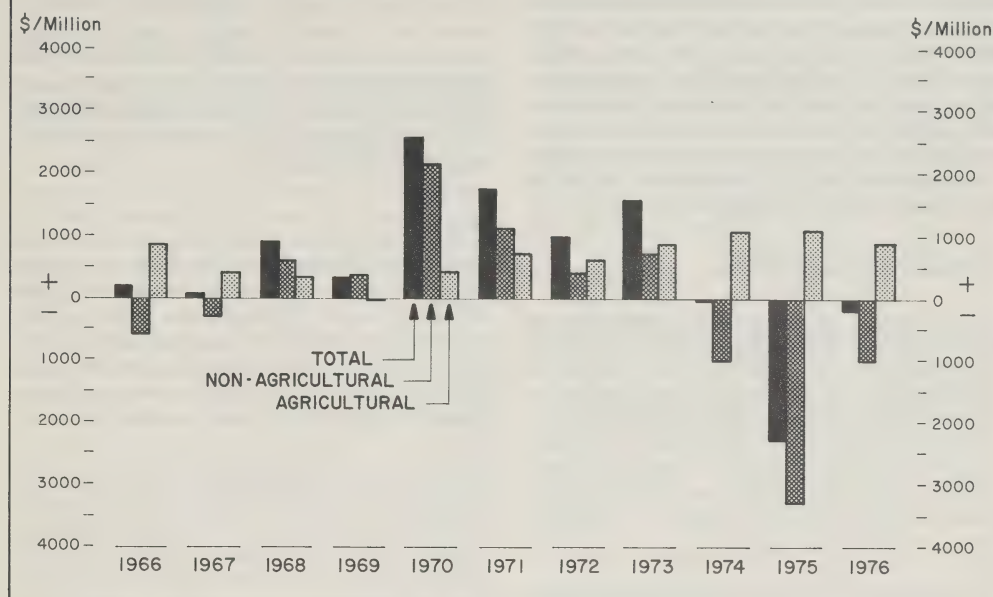


Figure 2

### IMPORT SYSTEMS FOR SPECIFIC COMMODITIES

Policy guidelines and self-sufficiency objectives alone do not fully determine the nature and size of the trade flow. It is important also to consider how they are implemented and particularly the conditions under which products enter a market.

#### Grains

Japan, while encouraging domestic production as much as possible, will be a net importer of grains over the long run. Hence for most grains grown in Japan (rice, wheat and barley), there are government price supports and import controls.

Wheat and barley are regulated by the Food Control Act (1942) and the Ministry of Agriculture and Forestry's Food Agency handles purchases, sales and imports. Producers are free in principle to sell their crops to any purchaser, but the government's high purchase prices have resulted in virtually all sales being made to the government which in turn sells at a loss. Japanese regulations allow the tariff on wheat and barley to be

waived as a result of the state monopoly on imports. While this helps to increase consumption of these grains, the government selling price relates little to the import price and thus can have either a positive or negative impact on the competitiveness of these grains. For example, barley is subject to these regulations but corn is freely traded at international prices. Barley is further discriminated against by being subject to dehulling (a process dating from a time when it was necessary to make barley a substitute for rice which was scarce). Dehulling now adds to the cost of imported barley at the border compared with competing feed grains such as corn and sorghum.

More important, however, Japan is one of the few countries where internal supply and demand dictate that it will be a long-run, major importer of these commodities. At the height of its concern for supply security in 1975, Japan made an agreement with the United States on supply levels for the next three years of three million tons a year each for wheat and soybeans and nine million for feed grains. The Japanese Minister of Agriculture indicated then that similar agreements would need to be made with other suppliers since Japan could no longer expect to import unlimited quantities of grains or other products at low prices.

Subsequently, there have been no further formal statements on supply commitments. Canada, Japan's second largest supplier of wheat, has the Canadian Wheat Board to enter into such commitments. Neither the Board nor the Food Agency, however, has seen any need to formalize on a long-term basis their existing arrangements which, by annual supply and purchase agreements, tacitly recognize the importance of both market and supplier in ensuring that trade continues and hopefully expands on a mutually satisfactory basis. The current agreement calls for the delivery in 1977 of 1.4 million tons of wheat and 900,000 tons of barley.

### **Oilseeds and Oilseed Products**

On the basis of its self-sufficiency projections and planned increases in livestock production, it is clear that Japan will also remain a major importer of oilseeds and oilseed products. In this respect Canada and Japan's interests mesh since Japan was the major market for rapeseed in 1976, taking 87 percent of Canada's rapeseed exports. Canada supplied 92 percent of Japan's rapeseed purchases in the same year, with the growing volume of imports replacing a major part of previously domestically produced oilseeds.

Despite this, there are some features of this trade which could be improved by ensuring stable expansion. Rapeseed, of course, has to be competitive with other oilseeds, including those tropical oils (such as palm oil) which have lower production costs, and also with soybeans in terms of the acceptability of rapeseed meal as an animal feed. There is considerable research underway in Canada to develop new varieties of rapeseed which meet these requirements.

Rapeseed enters Japan under the same tariff rates as soybeans; though a temporary tariff reduction, it is long-term. Given Japan's long-run needs in this area there appears to be no justification in maintaining this distinction. As a traditional food item in Japan, soybeans benefit from stockpiling assistance, whereas rapeseed does not.

Canada has also attached some importance to the feasibility of supplying more of Japan's requirements for rapeseed in the form of oil and meal, i.e., increasing the value-added prior to export. This would provide a wider base for the processing industry in Canada, giving additional stability to an industry in which production decisions depend somewhat on the relative profitability of other crops. Shipments of rapeseed oil, however, have not shown strong growth despite the expansion of the Canadian crushing industry, mainly because the crushing

capacity in Japan would be underutilized if significant quantities of oil were imported. This is reflected in the Japanese tariff structure which discriminates against further processed goods in favor of primary products. In considering this aspect of trade, it must be acknowledged that the Canadian freight rate structure does not encourage expansion of exports of processed products. (Rapeseed for export qualifies for the lower Crow's Nest rates whereas seed for processing prior to export and processed products do not.)

### **Pork**

Canada faces different problems in trying to expand its considerable exports of pork to Japan, since Japan's objective is to achieve 99-percent self-sufficiency in pork by 1985. There is little evidence, however, that Japan is approaching its goal. It had been suggested that pollution from intensive livestock enterprises might be an obstacle, but apparently this has been overcome.

This high level of self-sufficiency in pork assumes the availability of imported feed. Thus security of supply is no more assured by Japanese pork production based, for example, on imported Canadian barley than by imported Canadian pork produced from Canadian barley. Given Canada's comparative advantage in feed availability, it is not without cost to Japan to aim at such a high level of self-sufficiency. This cost could, of course, be reduced by allowing for the continuation of a certain amount of imports to meet increases in Japanese demand.

Whether or not Japan achieves its self-sufficiency objectives, its preference for particular cuts of pork make it likely that, at a minimum, there will continue to be a demand which can only be filled by supplementing domestic supply with imports.

Of more immediate concern is the fact that Japan's import system for pork prevents any accurate assessment of likely trends. When import quotas on pork were removed some years ago, they were replaced by what amounts to a minimum import price system based on established domestic prices. This is further complicated by import duties being waived when import prices exceed the established prices by a certain amount. This system, while effectively insulating Japanese producers from international prices, changes access conditions which do little to promote trade stability. Furthermore, pork imports entering under long-term supply commitments like much of the pork exported from Canada seem to be an unnecessary cost for Japanese consumers.

Despite these unfavorable aspects, Canadian pork exports to Japan have increased sharply in the 1970s, though fluctuations have resulted from the lifting and reimposing of import duties.

### Other Agricultural Products

There is also a large Japanese market for other Canadian agricultural exports (Table 3). There are, however, some potential export items that do not appear in Table 3. For example, apples from Canada and some other countries are denied entry because of the codling moth in these countries. To gain entry for Canadian apples, Canada has undertaken considerable work to develop a fumigation and cold storage system which destroys any codling moth larvae in apples before export.

Tobacco is another item for which sales have not been as high as hoped, basically because Japan maintains that Canadian prices do not match their price requirements. Since the tobacco trade involves many producing countries with differing production costs, product quality, curing methods and tastes, Canada is trying to work with Japan to establish more precisely the nature of Japanese requirements, in the hope of increasing its share of the market.

### PROSPECTS

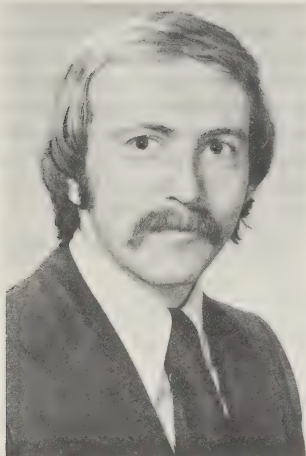
It is possible to expand the already significant and growing volume of Canadian agricultural exports to Japan. This depends, particularly for more-processed items, on Canadian exports remaining competitive with those of other suppliers and on Canada becoming more

familiar with Japan's requirements and marketing system. Improved terms of access for Canadian farm products are also required if exports are to expand. A major objective for Canada in the Multilateral Trade Negotiations underway in the General Agreement on Tariffs and Trade is indeed to obtain improved and stable access for agricultural products in export markets for the benefit of both importer and supplier. Provided progress is made in these areas, Canada should be able to retain its share of trade in those commodities imported by Japan, while increasing exports of products not exported in large volumes, e.g., tobacco, apples and processed food products.

### REFERENCES

1. Japanese Ministry of Agriculture and Forestry, 1976 White Paper on Agriculture.
2. Organization for Economic Cooperation and Development, Agricultural Policy in Japan, February 1974.
3. Parkinson, W.R. "Japan's Grain Trade and Long-Term Outlook", Agriculture Abroad, October 1976.
4. United States Department of Agriculture, Asia and Oceania Agricultural Situation, Foreign Agricultural Economic Report No. 133, April 1977.
5. "Look Japa", Vol. 20, No. 235, Tokyo, November 1975.
6. "Trade News — Food and Agriculture", Department of Industry, Trade and Commerce, Ottawa, various issues.

# COW-CALF SYSTEMS FOR THE MARITIME PROVINCES



James F. Gallagher\*

*The traditional cow-calf operation is based on selling spring calves after weaning. This article discusses three systems that Maritime cow-calf operators can use to increase beef production economically. It is intended mainly for farmers, extension workers and farm lenders.*

## INTRODUCTION

Beef production in the Maritimes increased sharply between 1969 and 1974—eight percent in New Brunswick, 10 percent in Nova Scotia and 12 percent in Prince Edward Island. This trend was partly due to farmers switching from dairy to beef. It was also due to producers' response to the steadily rising cattle prices and relatively stable grain prices since the mid-1960s (Figure 1). The trend continued in 1975 when production was 41 percent higher than in 1974, though this jump was partly the result of heavy marketings of cows and calves caused by low calf prices.

Production growth was not accompanied by favorable returns in the cow-calf sector. Data from experiments at Nappan, Nova Scotia and Fredericton, New Brunswick were used to make estimates of costs and returns (budgets) for several production practices that differed from those in the traditionally managed cow-calf enterprise. Using 1971-75 average prices for farm inputs and products it was found that these alternatives would improve returns. The desirability of changes was evident from a budget of a 100-cow "benchmark" farm which showed that returns were insufficient to cover full costs, including labor and capital.

This article first presents a budget for the benchmark farm and discusses the important factors affecting returns.<sup>1</sup> It then describes and analyzes budgets of three alternative practices that can be employed to increase returns on the benchmark farm. The first is finishing the steer calves on pasture and grain after wintering on grain and free-choice grass silage. The second is replacing some of the cows with heifers, breeding them early and selling them for slaughter two months after calving. The third is calving the herd in February rather than in the spring.

The budgets apply to the Maritime Provinces but can be used as guides for farmers in Quebec and Eastern and Northern Ontario, where climatic and economic conditions are similar. They are intended to help farmers plan their operations before making financial commitments. They will also be of interest to extension workers in advising farmers and to lenders wanting information on the profitability of beef operations. Finally, governments might find them helpful in policy planning.

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<sup>1</sup>This article is a synopsis of "Selected Beef Production Systems in the Atlantic Provinces", Economics Branch Publication No. 77/4, March 1977. The report was based on a project contracted with Dr. L.C. Cunningham, Professor Emeritus, New York State College of Agriculture and Life Sciences, Ithaca, New York; Dr. J.W.G. Nicholson, Research Station, Fredericton and Dr. James Lovering, Economics Branch, Charlottetown, made major contributions. The author is indebted to these people for their assistance.

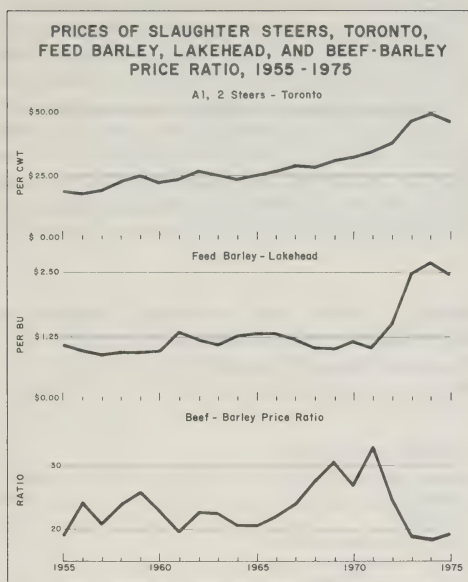


Figure 1

The opportunity cost principle is used in calculating labor and capital costs. It is derived from the notion that in a business the owner's own capital and labor should earn a return because these resources have the "opportunity" of earning a return elsewhere. Rather than make a hypothetical division between owned and borrowed capital, the article considers all capital owned. An interest rate of seven percent is used to calculate the cost of capital. Labor is assigned a value of \$3 per hour.

Interest and labor are considered non-cash costs. Building repairs are shown as a cash cost even though they may be done by the operator using his own woodlot.

## THE TRADITIONAL BENCHMARK FARM

The benchmark farm uses the traditional practice of selling calves at weaning. The budget assumes spring calving and loose housing in converted buildings or pole-frame structures. Pasture (165 days) is the main feed source in the summer. In the winter, dry cows are given hay and straw, with increased rations for nursing cows.<sup>2</sup> Feeding rates are representative of farm practices in the region and are shown in Table 1. Average prices of

<sup>2</sup>The winter season is divided into 124 days dry and 76 days nursing.

farm inputs and products for the 1971-75 period are used (Table 2). The seven-percent interest rate is a compromise between those on savings accounts and those on farm loans.

**TABLE 1. FEEDING RATES FOR TRADITIONAL BENCHMARK FARM**

| Animal                                  | Hay  | Straw | Protein    | Salt,   | Oats |
|---|------|-------|------------|---------|------|
|   |      |       | Supplement | Mineral |      |
| — lb per head per day in winter —       |      |       |            |         |      |
| Cows, dry, middle third<br>of gestation | 10.0 | 8.0   |            | 0.25    |      |
| Cows, dry, last third of<br>gestation   | 13.0 | 8.0   |            | 0.25    |      |
| Cows, nursing                           | 25.0 |       | 0.5        | 0.30    |      |
| Heifers, 1 to 2 yr                      | 19.0 |       |            | 0.25    |      |
| Heifers, under 1 yr                     | 13.0 |       | 1.0        | 0.25    | 4.5  |
| Bulls, 1 to 2 yr                        | 19.0 |       |            | 0.25    | 2.0  |
| Bulls, under 1 yr                       | 13.0 |       | 1.0        | 0.25    | 4.5  |

Source: J.W.G. Nicholson, Research Station, Fredericton, N.B.

**TABLE 2. 1971-75 AVERAGE PRICES OF FARM INPUTS AND PRODUCTS**

| Item                          | Price  |
|-------------------------------|--------|
|                               | — \$ — |
| Hay, per ton                  | 28     |
| Barley, per ton               | 75     |
| Bedding, per ton              | 10     |
| Pasture, per head per season  | 12     |
| Beef cows, per head           | 400    |
| Male feeder calves, per cwt   | 41     |
| Female feeder calves, per cwt | 32     |
| Slaughter steers, per cwt     | 39     |
| Slaughter heifers, per cwt    | 37.50  |
| Labor, per hour               | 3      |
| Interest rate, percent        | 7      |

Source: This and remaining tables are from Selected Beef Production Systems in the Atlantic Provinces, Economics Branch Publication No. 77/4, March 1977.

## Cattle Numbers and Transactions

The cattle inventory consists of 100 cows, 15 heifers and five bulls one to two years old, plus 15 heifers and five bulls under a year, a total of 140 head (Table 3). Calf crops at weaning are 88 percent for cows and 80 percent for first-calf heifers, yielding a total of 100 calves, 50 of each sex. Forty-five of the males are sold at weaning and the other five retained as bulls. Of the 50 female calves, 35 are sold at weaning and 15 kept as replacements. No

**TABLE 3. INVENTORY OF CATTLE FOR BENCHMARK FARM**

| Animal              | No. | Price/hd | Value  |
|---------------------|-----|----------|--------|
|                     |     | — \$ —   | — \$ — |
| Cows                | 100 | 400      | 40,000 |
| Heifers, 1 to 2 yr  | 15  | 375      | 5,625  |
| Heifers, under 1 yr | 15  | 144      | 2,160  |
| Bulls, 1 to 2 yr    | 5   | 280      | 1,400  |
| Bulls, under 1 yr   | 5   | 205      | 1,025  |
| Total               | 140 |          | 50,210 |

animals are bought, but 10 of the best cows are bred artificially to proven sires to provide replacement bulls from within the herd.

Thirteen cull cows are sold and two die and are replaced by the 15 yearling heifers. A death loss of two percent is assumed on the value of these 15 heifers. Five bulls are sold. The value of manure is assumed to cover removal costs.

### Returns

Total returns for the benchmark farm are \$18,772 (Table 4), consisting of calf, cull cow and bull sales minus the two-percent death loss on the 15 heifers. Average weights of weaned calves are 500 pounds for males and 450 pounds for females. Total costs are \$19,243, leaving a deficit of \$471.

### Major Cost Items

The most important single cost item was hay, which was two thirds of feed costs and one third of total costs. The budget price of \$28 per ton was based largely on official reports of farm prices during the period. Varying the price, changes the net income as follows:

|                             |                |               |               |                 |
|-----------------------------|----------------|---------------|---------------|-----------------|
| <b>Price per ton of hay</b> | <b>\$ 20</b>   | <b>\$ 28</b>  | <b>\$ 30</b>  | <b>\$ 40</b>    |
| <b>Net returns</b>          | <b>\$1,499</b> | <b>-\$471</b> | <b>-\$964</b> | <b>-\$3,427</b> |

Interest is the second highest cost. Interest charges for cattle, stored feed and buildings and equipment are \$4,534. Hence the rate has a strong impact on returns, as shown below:

|                         |              |               |                 |
|-------------------------|--------------|---------------|-----------------|
| <b>Rate of interest</b> | <b>5%</b>    | <b>7%</b>     | <b>9%</b>       |
| <b>Net returns</b>      | <b>\$825</b> | <b>-\$471</b> | <b>-\$1,767</b> |

In comparison, a change of one percentage point in the interest rate changes net returns by \$648 and a change of \$5 per ton in the price of hay changes net returns by \$1,231.

Though actual income data are not readily available, the financial picture is probably typical of commercial

operations in the region as a five-year average but not for any individual year. During the period there were sharp shifts in net farm incomes caused by fluctuating market prices of cattle and feed. At the same time the prices of some farm inputs rose persistently. Estimates from economic studies, informal reports from farm credit agencies and field observations suggest that farm incomes vary widely among beef farmers. The average group, however, is probably centered on a point where gross income is almost sufficient to cover full costs.

**TABLE 4. COSTS AND RETURNS, BENCHMARK BEEF CATTLE FARM, ATLANTIC PROVINCES<sup>a</sup>**

| Item  | Amount             |
|---|--------------------|
|   | — \$ —             |
| <b>VARIABLE CASH COSTS</b>                          |                    |
| Feed  | 10,696             |
| Bedding   | 1,000              |
| A.I. fees   | 80                 |
| Veterinary drugs and fees                           | 200                |
| <b>FIXED CASH COSTS</b>                             |                    |
| Utilities   | 100                |
| Building and equipment repairs, taxes and insurance | 350 <sup>b</sup>   |
| <b>VARIABLE NON-CASH COSTS</b>                      |                    |
| Labor   | 1,632 <sup>c</sup> |
| Interest on stored feed                             | 320                |
| Interest on cattle                                  | 3,515              |
| <b>FIXED NON-CASH COSTS</b>                         |                    |
| Building and equipment depreciation and interest    | 1,350 <sup>d</sup> |
| <b>TOTAL COSTS</b>                                  | <b>19,243</b>      |
| <b>RETURNS</b>                                      |                    |
| 45 steer calves @ \$205/hd                          | 9,225              |
| 35 heifer calves @ \$144/hd                         | 5,040              |
| 13 cull cows @ \$240/hd                             | 3,120              |
| 5 bulls @ \$300/hd                                  | 1,500              |
| Minus 2% of heifer value (\$5,625)                  | 113 <sup>e</sup>   |
| <b>TOTAL RETURNS</b>                                | <b>18,772</b>      |
| <b>TOTAL RETURNS LESS TOTAL COSTS</b>               | <b>- 471</b>       |

<sup>a</sup>The original report divides the herd into three enterprises: cow-calf, heifer and bull, showing the cattle transfers among the three. For simplicity's sake, however, this article presents costs and returns for the herd as a whole only.

<sup>b</sup>Building and equipment average investment is \$100 per cow. Of this, repairs are 2%, taxes 1% and insurance 0.5%.

<sup>c</sup>Labor is only for feeding and other management chores, with 544 hours budgeted as follows: cows 500 hours, heifers 24 hours and bulls 20 hours.

<sup>d</sup>Depreciation and interest are 6.5% and 7% of the \$100 investment per cow.

<sup>e</sup>Death loss on heifers

The 1971-75 period was unusual for the cattle industry for two reasons — the sharp rise in cattle and feed grain prices up to 1973 and the severe drop in feeder calf prices in 1974 and 1975. While some price decrease was expected because of farmers' tendencies to overexpand herds in response to favorable prices, it appears that the record grain prices forced a greater and more rapid liquidation of cattle herds in North America than might otherwise have occurred. Rapidly increasing hay prices in the same two years also aggravated the problem.

The results from the benchmark farm suggest the need for new practices or systems to increase the income. The following section analyzes several options available to farmers.

## FINISHING STEERS ON PASTURE

The calves on the benchmark farm are sold at weaning. An alternative would be to feed them to market weight as finished animals. A budget was prepared in which the 45 steers (50 minus five kept as bulls) on the benchmark farm are fed for 12 months before being marketed at about 20 months. The calves are fed grass silage free choice and grain during the winter and pastured with grain the following summer.

Feed consumption per head is 10,250 pounds of grass silage and 1,050 pounds of oats (Table 5). Feed costs are about \$100, interest \$17 and other costs, including death losses, are \$20. The weaned calves are each charged at the market value of \$205 (500 pounds at 41 cents), making total costs \$342.

**TABLE 5. COSTS AND RETURNS FOR FINISHING BEEF STEERS ON PASTURE**

| Item  | Amount<br>per Steer | Value     |           |
|---|---------------------|-----------|-----------|
|   |                     | per Steer | 45 Steers |
| — \$ —  |                     |           |           |
| VARIABLE CASH COSTS                                     |                     |           |           |
| Winter Period   |                     |           |           |
| Grass silage, lb  | 10,250              | 49.97     | 2,249     |
| Oats, lb  | 800                 | 26.80     | 1,206     |
| Summer Period   |                     |           |           |
| Oats, lb  | 250                 | 8.38      | 377       |
| Pasture, days   | 150                 | 10.00     | 450       |
| Salt, mineral mix, lb                                   | 88                  | 4.40      | 198       |
| Bedding, lb   | 1,400               | 7.00      | 315       |
| Veterinary, drugs                                       |                     | 0.67      | 30        |
| FIXED CASH COSTS  |                     |           |           |
| Utilities   |                     | 0.20      | 9         |
| Buildings and equipment repairs,<br>taxes and insurance |                     | 0.68      | 31        |
| VARIABLE NON-CASH COSTS                                 |                     |           |           |
| Labor, hr   | 2                   | 6.00      | 270       |
| Interest on stored feed                                 |                     | 3.13      | 141       |
| Interest on cattle                                      |                     | 14.35     | 646       |
| Death loss  |                     | 3.08      | 139       |
| Steer calf, lb  | 500                 | 205.00    | 9,225     |
| FIXED NON-CASH COSTS                                    |                     |           |           |
| Building and equipment<br>depreciation and interest     |                     | 2.72      | 122       |
| TOTAL COSTS   |                     | 342.38    | 15,408    |
| CASH RETURNS  |                     |           |           |
| Steer, lb   | 1,050               | 409.50    | 18,428    |
| TOTAL RETURNS   |                     | 409.50    | 18,428    |
| TOTAL RETURNS LESS TOTAL COSTS                          |                     | 67.12     | 3,020     |

Gross returns from the steers are \$410 per head, assuming a market weight of 1,050 pounds and a selling price of 39 cents; net returns are \$67 per head and \$3,020 for the 45 calves.

This option will not be open to all producers since additional resources are required. The favorable returns suggest, however, that it should be tried on a small scale at least. Producers could consider reducing cow numbers and putting the resulting extra resources into this option.

## ONCE-CALVING HEIFERS

On the benchmark farm 100 calves (50 of each sex) are produced, using the traditional system of cow culling and replacement. This section discusses a system in which some heifers are bred early, calved and slaughtered 56 days later before they reach two years of age. The budget assumes the same number of calves weaned as on the benchmark farm and the same calf crops. The breeding herd is described in Table 6.

**TABLE 6. BREEDING HERD FOR ONCE-CALVED HEIFER SYSTEM**

| Females            | Calf Crop  |       | Calves Weaned |
|--------------------|------------|-------|---------------|
|                    | — No. —    | — % — | — No. —       |
| Cows               | 75         | 88    | 66            |
| First-calf heifers | 43         | 80    | 34            |
| <b>TOTAL</b>       | <b>118</b> |       | <b>100</b>    |

The budget is for a year in which the system is in operation, rather than for a transitional period. There are 50 heifers to choose from in the herd. Seven are assumed unsuitable for breeding and are culled, leaving the 43 indicated in Table 6. Eleven of these are kept as cow replacements, and the remaining 32 are calved, kept to nurse their calves for 42 days and marketed 14 days later. The 42-day-old calves are fed calf starter until the end of the pasture season. The seven cull heifers and 45 steer calves (50 minus five kept as bulls, as on the benchmark farm) are marketed at the end of the pasture season.

Table 7 contains feed cost comparisons for the 75-cow herd with those of the 100-cow benchmark farm. Hay consumption is higher in the 75-cow herd, but less straw is fed since more heifers are raised. For the same reason more protein supplement is fed. The additional feed cost for the once-calved heifers for 56 days is \$771, with \$1,086 budgeted for feed for their calves. Total feed costs are \$14,618, about \$3,600 higher than in the 100-cow herd.

## Returns

Sales for the herd are \$26,339 (Table 8), \$7,567 more than the 100-cow herd. Sales of the once-calved heifers more than offset reductions in calf and cull-cow sales and the increase in feed costs.

The net returns for the once-calved heifer system are \$3,837 greater than those for the benchmark farm (Table 9). This favorable result suggests that the system can be used to increase beef production economically.

**TABLE 7. FEED COSTS, 100-COW AND 75-COW HERDS<sup>a</sup>**

| Item                            | Amount       |             | Value              |                    |
|---------------------------------|--------------|-------------|--------------------|--------------------|
|                                 | 100 Cow Herd | 75 Cow Herd | 100 Cow Herd       | 75 Cow Herd        |
| Hay, tons                       | 238          | 283.3       | 6,664              | 7,932              |
| Oat straw, tons                 | 49.6         | 37.2        | 496                | 372                |
| Oats, tons                      | 10           | 22.6        | 670                | 1,514              |
| Protein supplement, lb          | 8,370        | 13,764      | 628                | 1,032              |
| Salt, mineral, lb               | 13,212       | 14,540      | 660                | 727                |
| Pasture                         | —            | —           | 1,580 <sup>b</sup> | 1,512 <sup>c</sup> |
| Feed, once-calved heifer calves | —            | —           | 0                  | 1,086              |
| Interest, stored feed           | —            | —           | 320                | 443                |
| <b>TOTAL FEED COSTS</b>         |              |             | <b>11,018</b>      | <b>14,618</b>      |

<sup>a</sup> The 100-cow herd comprises 100 cows, 15 heifers and five bulls one to two years and 15 heifers and five bulls under one year. The 75-cow herd comprises 75 cows, 43 heifers and five bulls one to two years of age and 43 heifers and five bulls under one year.

<sup>b</sup> 115 cows at \$12 per head and 15 yearling heifers and five yearling bulls at \$10

<sup>c</sup> 86 cows at \$12 per head and 43 yearling heifers and five yearling bulls at \$10

**TABLE 8. CATTLE SALES FOR ONCE-CALVED HEIFER SYSTEM**

| Animals                 | No. Sold | Value  |
|-------------------------|----------|--------|
|                         |          | — \$ — |
| Once-calved heifers     | 32       | 12,768 |
| Steer calves            | 45       | 9,225  |
| Heifer calves (culls)   | 7        | 1,008  |
| Cull cows               | 9        | 2,160  |
| Bulls                   | 5        | 1,500  |
| Total                   | 98       | 26,661 |
| Minus heifer death loss |          | 322    |
| Net sales               |          | 26,339 |

**EARLY CALVING**

Experiments investigating the effect of different calving dates on returns showed a distinct advantage to early

calving (mid-February) compared with late (end of April). A budget based on the benchmark farm compared the returns from the two calving dates (Table 10).

The early male calves weigh 535 pounds and the late ones 426 pounds, a 26-percent difference; the early females are 481 pounds and the late ones 387, a 24-percent difference. The assumed calf crop is 86 percent.

Feed costs are higher for the early-calving cows because they are on the higher-quality nursing ration 95 days before pasture time compared with only 20 days for the late-calving cows. Other costs, except interest, were budgeted the same for each group.

Gross returns are \$199 per cow for early calving and \$168 for late (Table 10). Net returns are \$2 per cow for early calving, while late calving shows a deficit of \$11.

**TABLE 9. COMPARISONS OF COSTS AND RETURNS FOR 100-COW AND 32 ONCE-CALVED HEIFER HERDS**

| Item   | 100<br>Cow Herd | 75<br>Cow Herd | Difference    |
|--|-----------------|----------------|---------------|
|  |                 | — \$ —         |               |
| <b>VARIABLE CASH COSTS</b>                             |                 |                |               |
| Feed   | 10,696          | 14,175         | +3,479        |
| Bedding  | 1,000           | 1,080          | +80           |
| A.I. fees  | 80              | 64             | -16           |
| Veterinary, drugs                                      | 200             | 192            | -8            |
| <b>FIXED CASH COSTS</b>                                |                 |                |               |
| Utilities  | 100             | 88             | -12           |
| Building and equipment repairs,<br>taxes and insurance | 350             | 332            | -18           |
| <b>VARIABLE NON-CASH COSTS</b>                         |                 |                |               |
| Labor  | 1,632           | 1,391          | -241          |
| Interest on stored feed                                | 320             | 448            | +123          |
| Interest on cattle                                     | 3,515           | 3,880          | +365          |
| <b>FIXED NON-CASH COSTS</b>                            |                 |                |               |
| Building and equipment<br>depreciation and interest    | 1,350           | 1,328          | -22           |
| <b>TOTAL COSTS</b>                                     | <b>19,243</b>   | <b>23,973</b>  | <b>+4,730</b> |
| <b>CASH RETURNS</b>                                    |                 |                |               |
| Cull cows  | 3,120           | 2,160          | -960          |
| Once-calved heifers                                    | —               | 12,768         | +12,768       |
| Bulls  | 1,500           | 1,500          | 0             |
| Calves <sup>a</sup>                                    | 14,152          | 9,911          | -4,241        |
| <b>TOTAL RETURNS</b>                                   | <b>18,772</b>   | <b>26,339</b>  | <b>+7,567</b> |
| <b>TOTAL RETURNS LESS TOTAL COSTS</b>                  | <b>-471</b>     | <b>3,366</b>   | <b>+3,837</b> |

<sup>a</sup>net of heifer death losses

**TABLE 10. COSTS AND RETURNS FOR EARLY AND LATE CALVING OF COWS, BENCHMARK FARM**

| Item  | Amounts per Cow |       | Values for Herd |               |
|---|-----------------|-------|-----------------|---------------|
|   | Early           | Late  | Early           | Late          |
| — \$ —  |                 |       |                 |               |
| <b>VARIABLE CASH COSTS</b>                            |                 |       |                 |               |
| Dry Period  |                 |       |                 |               |
| Hay, lb   | 1,320           | 2,070 | 1,848           | 2,898         |
| Oat Straw, lb   | 840             | 1,440 | 420             | 720           |
| Salt, mineral, lb.                                    | 26              | 45    | 130             | 225           |
| Nursing Period  |                 |       |                 |               |
| Hay, lb   | 2,375           | 500   | 3,824           | 805           |
| Protein supplement, lb                                | 48              | 10    | 414             | 86            |
| Salt, mineral, lb.                                    | 70              | 47    | 402             | 270           |
| Pasture   |                 |       | 1,380           | 1,380         |
| Feed for heifers and bulls                            |                 |       | 2,710           | 3,031         |
| Bedding   |                 |       | 1,000           | 1,000         |
| A.I. fees   |                 |       | 80              | 80            |
| Veterinary, drugs                                     |                 |       | 200             | 200           |
| <b>FIXED CASH COSTS</b>                               |                 |       |                 |               |
| Utilities   |                 |       | 100             | 100           |
| Building and equipment repairs<br>taxes and insurance |                 |       | 350             | 350           |
| <b>VARIABLE NON-CASH COSTS</b>                        |                 |       |                 |               |
| Labor   |                 |       | 1,632           | 1,632         |
| Interest on stored feed                               |                 |       | 334             | 274           |
| Interest on cattle                                    |                 |       | 3,515           | 3,515         |
| <b>FIXED NON-CASH COSTS</b>                           |                 |       |                 |               |
| Building and equipment<br>depreciation and interest   |                 |       | 1,350           | 1,350         |
| <b>TOTAL COSTS</b>                                    |                 |       | <b>19,689</b>   | <b>17,916</b> |
| <b>RETURNS</b>  |                 |       |                 |               |
| Male calves, weaning, lb                              | 535             | 426   | 9,871           | 7,860         |
| Female calves, weaning, lb                            | 481             | 387   | 5,387           | 4,334         |
| Cows and bulls  |                 |       | 4,620           | 4,620         |
| <b>TOTAL RETURNS</b>                                  |                 |       | <b>19,878</b>   | <b>17,916</b> |
| <b>TOTAL RETURNS LESS TOTAL COSTS</b>                 |                 |       | <b>189</b>      | <b>-1,102</b> |

For the herd this is a significant difference of \$1,291 in favor of early calving, showing that the calving date is a major factor affecting returns in a cow-calf operation. In their experiments the researchers saw no unusual problems in early calving and suggested that it is a feasible alternative.

## DISCUSSION

The assumption of no debt does not apply to all farmers. Most have some debt and in applying these budgets they should make appropriate adjustments. Paid interest, for

example, would be a cash cost and interest on owned capital would be a non-cash cost. Different interest rates can be used depending on the return desired.

Farmers will justifiably argue that the \$3 per-hour rate is low. The \$1,632 labor charge for the traditional benchmark farm is only for the 544 hours required to feed and look after the cattle. Excluding labor from costs would mean that any returns are returns to labor. Clearly the returns to labor in the traditional benchmark farm would be very unsatisfactory if a farmer valued his labor, including management, at \$6 or \$7 per hour.

Not all beef producers could be expected to employ all three systems analyzed here. No doubt some are already using one or more of them, but the extent to which producers might use them depends on their managerial ability, resources and objectives. As indicated previously, finishing calves requires additional resources, much like adding a new enterprise to the farm. It may, however, involve the least risk among the three options, besides farmers needing to be familiar with grading standards and the importance of high rates of gain and feed efficiency in the feedlot.

The once-calved heifer system, the success of which is largely based on selling heifers while still grading well, may require a higher level of management. Documented problems with such a practice are not available, but early breeding a significant number of heifers and weaning their calves at six weeks may require considerable expertise to keep heifer and calf losses at a minimum.

Though the researchers reported no unusual problems with early calving, in practice it may require more care to protect calves from disease and cold stress. The 86-percent calf crop was assumed for both calving dates, though a slightly lower crop could realistically be used for early calving. It is interesting to note that although early calving yielded greater returns at weaning, the late calves gained faster in the feedlot.

The three practices described here, in addition to increasing returns, also reduce the capital turnover time, that is, the time required for gross returns to equal capital investment. Individual farmers undoubtedly attain higher returns through innovative techniques for feeding and housing and higher calf crops than shown in the budgets. Such management aspects are widely discussed by extension workers and farmers and no attempt is made here to discuss them.

## SUMMARY

Budgets were prepared from the results of experiments with beef cattle at research stations in Nappan, Nova Scotia and Fredericton, New Brunswick.

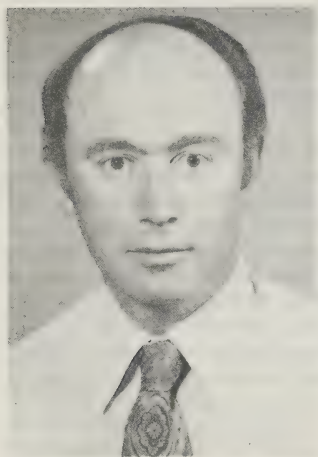
Using 1971-75 average prices for farm products and inputs, including capital and labor, it was found that the traditional practice of selling spring calves at weaning yielded unfavorable returns. A budget for a 100-cow benchmark farm showed costs exceeding returns by \$471. Hay was the critical single cost item, making up two thirds of feed costs and one third of total costs. Interest was the second highest cost.

Experiments showed that three production practices different from those in the benchmark farm would increase returns. Finishing the benchmark farm steer calves on pasture and grain, instead of selling them at weaning, yielded a return of \$3,020. Another profitable practice was calving some heifers, weaning the calves at 42 days and selling the heifers for slaughter 14 days later. This resulted in net returns of \$3,366 for the herd. Finally, a budget showed that net returns from February calving exceeded those from spring calving by \$1,291.

## REFERENCES

- Carmichael, S.J. "Trends in Production of Forage Crops in Canada", Canadian Farm Economics, Vol. 11, No. 4, August 1976, pp. 15-22.
- Pugh, G.E. "Instability in the World Beef Market", Canadian Farm Economics, Vol. 12, No. 4, August 1977, pp. 1-9.
- Selected Beef Production Systems in the Atlantic Provinces, Economics Branch, Agriculture Canada, Publication No. 77/4, March 1977.
- Agricultural Statistics, New Brunswick, Nova Scotia and Prince Edward Island.
- Beef Cattle Production in the Atlantic Provinces, Agriculture Canada, Publication No. 1494, Revised 1974.
- Research Summary 1975, Experimental Farm, Nappan, Nova Scotia.

# EFFECTIVE FARM MANAGEMENT



K.J. McKenzie\*

*Because of the growing challenge of today's farm business, effective farm management is imperative. The author has taken a respected method for analyzing and evaluating managerial effectiveness and shown how it can be used by farm managers. Specifically he considers three types of situations that managers usually face while attempting to achieve their goals: problem identification, choosing options and analyzing potential problems.*

## INTRODUCTION

The task of managing a modern commercial farm is complex. More and more young farmers are finding that the road to a successful farming career includes university training in agriculture. Those who do not take formal courses must learn quickly on their own or fall by the wayside. Not only must today's farmer cope with an immense body of physical and biological information, he also must deal with changing tax laws, increasing economic pressures to substitute capital for labor and a host of government programs intended to assist him.

Hence it is important to understand how good managers manage and how less skilled managers can be more effective. One method for analyzing and evaluating managerial effectiveness was developed in the 1950s by C.H. Kepner and B.B. Tregoe.<sup>1</sup> Although their method is used primarily in non-farm businesses and government, it appears to be relevant for farm managers as well; indeed it can probably be adapted to almost any managerial situation, including one's personal affairs.

This article attempts to adapt the Kepner-Tregoe approach for use by farmers and extension specialists. The reader who is already knowledgeable about certain aspects of farm management can readily fit his knowledge into this general framework. In no way does this framework replace the contributions of animal scientists, crop specialists, economists, accountants and financial experts to farm management; instead, it focuses on the processes which farm managers must use as they attempt to cope with their own particular situations.

Basically the farm manager is responsible for getting desired results. As Manning Becker, a popular farm-management lecturer at Oregon State University often says, "The job of the manager is to use what he's got to get what he wants." Of course, the manager's first task is to decide what he wants. Many things that farmers and their families in Canada want can be bought with money; thus one desired result of farming is cash income. The income goals which farmers set will likely be a compromise between what they would like to have and what they realistically think they can achieve. (This is not, of course, unique to farmers.) Farmers must also organize their businesses to permit achieving goals which can't be reached by using money, e.g., more leisure time, participation in community activities and maintaining certain social relationships. (For example, the farmer whose wife will not tolerate a particular kind of livestock will usually engage in another enterprise.) But whatever goals the farmer and his family have, the

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<sup>1</sup>C.H. Kepner and B.B. Tregoe, *The Rational Manager, A Systematic Approach to Problem Solving and Decision Making* (New York: McGraw Hill, 1965).

manager must attempt to realize these using the resources at his disposal.

Achieving outstanding results from limited resources is the mark of a good manager. It is not nearly so challenging to earn an annual income of \$10,000 with equity capital of \$150,000 as it is with \$50,000. And the farmer who enjoys good health and can easily work long hours should find that his income can be maintained or increased more easily than his neighbor who has a physical handicap.

The farmer's land, buildings, livestock and family usually make up the set of resources with which he has to work. Some of these can be changed in character or exchanged for other resources, or added to by renting land or borrowing money. But at any time, the farmer must take what he has and try to get what he wants out of it.

### **Situations Managers Face**

Kepner and Tregoe showed that all managers have to deal with three types of situation:

- problem identification (What went wrong? ),
- choosing an option (What course of action? ) and
- anticipating and preventing problems (What might go wrong? ).

The appropriate ways of handling these three types of management situation are significantly different. The first is likely to be in the domain of skilled diagnosticians such as the veterinarian or skilled mechanic; the second is often the concern of the economist or extension specialist whose interest is usually in increasing profits; the local insurance agent specializes in the third. Since the farm manager deals with all three, he usually finds it useful to use the services of a wide variety of people.

## **PROBLEM IDENTIFICATION**

### **Need for Performance Measures**

A problem can be defined as a deviation between what a manager expects should happen and what actually occurs. These deviations can be identified by comparing a set of planned results with observations of the way things turn out as the plan is implemented. A plan to produce an annual net income of \$10,000 selling milk and calves from a dairy herd of 30 cows will generate many expected levels of performance, including levels of production, herd health standards and expected calving intervals. The skilled dairyman will continually monitor these to see that things are going as they should. If milk

production falls off or if cows do not get settled, he will detect such deviations, identify the cause and take corrective action.

The farm manager who is good at identifying problems must have very specific performance measures for his farm business. The more specific and precise his performance standards the better chance he will have of identifying any problem which occurs. The skilled manager will have precise expectations about diverse aspects of his business, e.g., the way the combine should work to the way the income and balance sheet should look at the end of the year.

### **Monitoring Results**

The manager who develops specific plans and goals for his farm business must set up and use effective methods to monitor actual results and compare them with his planned results. Many tools and procedures might be used for this. For livestock they include production records, periodic tests for disease, breeding records, close attention to the brood herd at calving, etc. Financial records, although useful, can only record some of the end results of the production-marketing system which the farmer has a responsibility to guide, and good physical records will not determine the profitability of the business. The farmer may obtain the desired physical production but fall short on profit. Hence he needs to keep both production and financial records to enable him to identify all significant problems.

The manager must be careful in allocating his scarce monitoring time. For example, it might not be necessary to check the cattle on pasture daily. Detailed financial records might not be necessary in some situations when something simpler would provide the basic information required. The skilled manager carefully chooses a few key performance factors and monitors these with a minimum of time and effort.

### **Recognizing the Problem**

It is one thing to notice that a problem exists but it is another to recognize it and appreciate whether or not it is a problem that the manager can and should do something about. Skilled managers are ready and willing to admit when things do not go as planned. The farmer who buys a used tractor and notices large amounts of blue smoke coming from the tail pipe a few weeks later may be reluctant to discover why and thereby acknowledge that he might have made an embarrassing mistake. The poor manager is too willing to attribute poor results to bad luck and avoid trying to understand his problem.

Thus when a significant problem is detected, the good manager quickly attempts to discover what went wrong and if he can do something about it. He has a firm idea of the size of deviation he should regard as a problem, and is able to distinguish random variations in performance from systematic ones. For example, the death of some lambs at birth is not unusual; but the farmer must decide what level of death loss indicates that things are not going the way they should.

## Identifying the Cause

Once a problem is identified the farmer must use a logical and effective approach in attempting to discover the cause. First he must clearly define the exact nature of the problem. For example, if he notices a sickly pig in the litter he must try to identify all of its symptoms and note exactly when the sickness first occurred. He must investigate to see if other pigs have the same symptoms and check the symptoms against authoritative information (publications or a local veterinarian) to identify possible diseases or causes of illness. He should also check if any recent changes in feeding, environment, etc., might have caused the problem. He will avoid jumping to conclusions and treating the symptoms instead of the most likely cause. The farmer who gets a lower-than-expected price for his cattle should look at all possible causes. Was it because of poor markets, a bad deal, inferior quality or light weight? If crop yields appear low, the good manager will check acreage and quantity estimates, and make sure that the amount harvested was reasonably related to the amount produced. (Harvesting losses may be the reason for his poor final yields.) Of course it is not always necessary to know the cause of a problem to deal with it effectively (e.g., a broken fence), but the good manager will want to know the cause anyway so he can try to ensure that it doesn't happen again.

Thus skill in setting goals, monitoring results, recognizing problems and identifying causes provides a sound basis for dealing with the first of the three general situations which all managers face. These skills are essential for the sound and effective implementation of any farm plan. They will form the basis for ensuring that the business is kept on track as much as possible.

## CHOOSING AN OPTION

When a farmer has identified a problem he usually must select one of several courses of action. There are two other general occasions when the farmer must make a choice — when new opportunities (or new external limitations) arise and when family goals and objectives

change. Both of these are different from the problem situation discussed earlier because, while nothing has necessarily gone wrong with the farmer's plan up to the present time, the farmer must make choices on how he should operate in the future within a changed frame of reference from what he had in the past.

New opportunities might arise because of changes in technology, markets or institutions. The best manager is continually monitoring these areas to detect changes which could have implications for his operation. For example, the dairy producer must keep aware of possible changes in market regulations that may affect him, and the grain producer should be checking market outlook information to assess whether he should be considering a different cropping program for the next year. The beef cow-calf operator must be on top of opportunities to upgrade the quality of his herd by changing his breeding program. And virtually all farmers must note changes in tax laws, credit availability and legislation which directly affect them.

Changes in family goals and objectives do not occur frequently, but when they do, they often present major choices for the farm manager. A son who wants to enter (or leave) the business, a sudden illness or the need to take it easier as retirement approaches are all examples of situations where family goals change and give rise to major decision situations.

## Identifying Options

Identifying relevant courses of action is the first step in the decision process. Detailed knowledge of a new opportunity or a problem in the farm business often permits one to identify options quickly. Unexpected machinery breakdown makes one think of repairs, trading for a new machine, borrowing a neighbor's, etc. Even so, some promising choices may be overlooked. Maybe the farmer should consider renting a replacement for the rest of the season, modifying his operation so that the machine is not needed at all, or using custom work. When considering new technology, the manager must consider not only the technology he sees, but he should also think about how the basic principle behind it might be implemented on his farm. Sometimes managers waste a lot of time analyzing irrelevant considerations. (There is little point comparing several different cars until the farmer has clearly decided that he needs a car and not a pick-up truck.) A few promising options will often permit the farmer to come close to the best possible solution.

## Essential and Desired Results

Before actually choosing, the manager must clearly specify the essential and desired results he wishes to achieve. Expected levels of desired results for the plan finally chosen will become performance levels to be achieved when that plan is implemented. Clear specification of essential results allows the manager to eliminate some irrelevant plans without completely analyzing them. It also enables him to avoid untenable situations. If he must cross a bridge to get to his other section of land, he certainly will have to buy or rent machinery which can cross that bridge. Or if he must have a plough which can be used with his existing tractor, there is little point in looking at ploughs which cannot.

Sound judgement is required to differentiate essential criteria from those which are merely desirable. A proposed livestock program may be very profitable but may not generate cash in time for the mortgage payment. If he makes this an essential criterion in his analysis of options, he may discard the proposed program without considering the use of short-term financing.

Desired results should be specified in a way which will be consistent with the overall desired results for the business. Profit, the common objective, creates a set of marginality principles for maximizing profit in making a wide range of decisions. But if the farmer also wants to maintain a certain level of leisure time, he must pay close attention to changes in his labor required in choosing cropping programs, buying machinery, etc. Farmers frequently focus on proxy performance measures such as crop yields or rates of gain when they are really interested in profit. Such proxy measures are convenient decision aids, but they can fail under certain circumstances. The good manager uses proxy performance measures but always asks himself if this is really what he wants to achieve. In addition, most farmers will want to keep both short-term and long-term objectives in sight. For example, it may be possible to obtain a crop or two of grain from a hilly field when prices are good but this could erode the field so badly that future productivity would be seriously diminished.

The farm manager must make sound and realistic estimates of the levels of desired results he expects to get from each option being considered. The farmer who refuses to consider buying a purebred dairy cow because his neighbor bought one that died is obviously not making a realistic estimate of expected results. The farmer must also be careful not to waste time making very precise estimates which are not needed. For

example, in some areas the costs of producing several grain crops may be almost the same. Making the best selection rests largely on an analysis of expected yields and prices, not costs. (Of course, other factors such as risk, times of harvest and planting and storage requirements may also be relevant.)

One of the important characteristics of farming is that there is a great deal of variation in the way products can be produced. Beef, for example, can be produced with a wide range of feeds, rates of gain, types of cattle and environmental conditions. The good manager usually knows precisely the results to expect from the options he considers. If he doesn't, he will conduct a trial to test his plan.

## Making a Decision

The astute manager will logically and consistently weigh the results expected from various choices. Increased profit, an obvious criterion, provides a convenient way of combining costs and returns into a single measure of results expected. But options may have similar levels of profitability and be distinguished from each other on the basis of criteria such as risk, amount of work required to implement, use of credit (which the manager may wish to hold in reserve), etc.

Successful managers can quickly assess their options in terms of their overall objectives and often do so without major analytical exercises. Partial budgeting is a convenient way to assess modest changes in the business (e.g., changes in rations, increased use of fertilizer, etc.). The effective manager knows when this sort of exercise should be replaced by a more complete analysis of available plans. But regardless of the complexity of the methods used in making the comparison, the manager must ensure that all relevant expected results are considered before making his decision. Only then can he have confidence that his choice was sound.

## ANALYSIS OF POTENTIAL PROBLEMS

After choosing a promising course of action, a manager must not only carry it out but he must also attempt to identify what might go wrong when he does so. Anticipating problems in some situations might make him decide that his choice was not the best, and return to comparing his choice with other options. In other situations, the manager may simply get an indication of things to look out for as he proceeds. In yet others, he might see more clearly how he can best implement his decision. Anticipating problems usually leads the manager to either eliminate the causes or prepare contin-

gency plans. This often results in a detailed plan which indicates when he should carry out certain activities, what techniques he should use and with whom (individual or company) he should deal.

### **Anticipating Problems**

After deciding on a course of action, the manager must develop a schedule of activities to implement his decision. As he thinks through his plan, he must continually ask himself "What might go wrong?" He must decide if he can get the supplies he needs in time, when he has to carry out field operations and if his equipment will allow him to get the crop in on schedule.

A farmer who decides to borrow money to buy more land might identify a wide range of potential problems which could result from this choice. He might be unable to meet the mortgage payments, have insufficient machinery to get the work done on time, have to spend more money on land improvements or not have enough labor at harvest time.

### **Possible Causes of Problems**

One step in the process of analysis is to identify possible causes of the anticipated problems. A problem might arise for more than one reason. In the situation described above, the farmer may not be able to meet his mortgage payment because of low prices, crop failure due to bad weather or because he had to cope with some other problem on the list. The potential machinery problem may be related to one particular machine or to several, or to the existing condition of the machinery. The ways to deal with the cause of the problem will of course differ, but contingency plans are often the same, regardless of the cause. For example, the farmer may determine that if he can't meet his mortgage payment, he can readily use his credit reserve at the bank to carry him for a few months until he has other revenue.

### **Likelihood of Problems Arising**

The farm manager will also want to determine the probability of potential problems. The chances of not being able to meet the mortgage payment might be small or large depending on the farmer's projected cash flow and the potential variability in factors such as prices and yields. If chances are small, a contingency plan such as that noted above may suffice; if large, the farmer might wish to reconsider his decision. (Indeed, this consideration should probably have been part of his original decision analysis. But if it wasn't and he identifies it in the process of anticipating problems, he can always return to a comparison of basic options — to buy or not to buy the land.) Or he may wish to look for a mortgage

holder who will understand his situation and provide for his one or two missing payments. Or he may consider something he hadn't thought of before — rental with option to buy.

### **Assessing the Seriousness of Potential Problems**

The farm manager must also consider how serious a problem could be if it does arise. There might only be a small chance of him getting sick and not being able to cope with the extra land, but if he can't hire help or get assistance from neighbors he may have a serious problem. It could lead to a lost crop, a missed mortgage payment and a foreclosure. And if a farmer bought a used tractor at an auction during harvest time and a week later found it needed a major overhaul he would be in a serious position indeed (which could have been avoided by buying the tractor earlier and making sure it was in excellent condition well before it was needed for harvest).

### **Prevention**

Once the farm manager has identified possible causes of all potential problems, he can consider methods of prevention. Although he cannot control the weather, he might be able to design a cropping program which has a low risk of failure due to bad weather. Some cropping programs, especially those which rely heavily on one crop, can expose the farmer to a high level of risk. Spreading the planting and harvesting activities among different crops might help the farmer to keep potential losses due to weather at a minimum. This would enable him to meet his financial commitments even in a bad year. Weed and insect control programs might be undertaken to prevent crop losses, and machinery could be repaired before it is needed in the spring.

### **Contingency Plans**

The causes of some problems, including bad weather and changes in market conditions, are beyond the control of the farm manager. While he cannot take actions to prevent these problems, he can develop contingency plans to ensure that, if they do arise, the effects on his business are minimized. Hail, wind, fire and crop insurance are excellent examples of contingency plans. Avoiding situations where crops or livestock have to be sold to meet financial commitments is another example.

Good managers will have contingency plans for a wide variety of situations which could arise in their business. These could vary from maintaining a credit reserve at the local bank to being able to borrow the neighbor's tractor if his own breaks down. Developing a set of contingency plans is the last major element in the planning process.

## SUMMARY

This article has adapted the Kepner-Tregoe view of the managerial process to situations faced by farmers managing their farm businesses. Three basic types of managerial situation have been discussed: problem identification, choosing an option and analysis of potential problems. It was seen that effective management is the ability to deal with each of these three types of situation expeditiously and economically.

Further adaptation of the Kepner-Tregoe approach to practical farm situations would involve using a set of case-study farms. The case studies would reveal the importance of economics and biological sciences at various points in the overall management function. This would make the process more tangible and meaningful to farmers and students of applied farm management. It is unlikely, however, that the basic principles for analyzing the three managerial situations would change. These principles seem sufficiently powerful to be applicable to a wide variety of farm businesses.

# NOTE: AN OBSERVER'S REPORT ON THE SYMPOSIUM ON CANADA AND WORLD FOOD<sup>1</sup>

## INTRODUCTION

The symposium speakers had some good news and some bad news for Canadians. The good news was that Canada can make a significant contribution toward easing the world food problem. The bad news was that it is not likely to be in the form of greatly expanded production of Canadian commodities for export. For consumers the message was that we must work harder and seek our satisfactions less in conspicuous, wasteful expenditures.

A panel of experts from all over North America treated issues ranging from ethics to engineering and from power politics to the Green Revolution. Many excellent contributions on the characteristics and needs of developing countries are ignored in this report, which concentrates on issues directly affecting Canadian producers and consumers.

## AGRICULTURAL PRODUCTION POTENTIAL

Speaking for production specialists, L.H. Shebeski, Dean of Agriculture, University of Manitoba, observed that if effectively mobilized, Canadian resources could support a several-fold increase in levels of output. He said that we could even supply fuel for such an expansion by converting straw. But Michael Shaw, Academic Vice-President, University of British Columbia, pointed to the dangers in the more intensive use of our agricultural resources. Unless we are careful, he said that our efforts to expand output may jeopardize our long-run physical capacity to feed even ourselves. For example, less than one-half the original organic matter is left in the soils of the Great Plains; the average annual loss is 12 tons per acre, while new top soil formation is only 1.5 tons per acre. This enormous loss of top soil, especially organic matter which is the storehouse for mineral elements essential to plants, is a clear decrement to production

potential. Under current practices, however, it is more than offset by inputs of energy from outside the agroecosystem — an equivalent of five gallons of fuel per acre. But energy substitution does not solve the long-term problem of maintaining the land resource. Conservation is expensive and incentive is often missing.

Intensified agricultural production entails other undesirable consequences such as plant and animal diseases, with the potential for crop disasters and the irreplaceable loss of genetic material. Controlling disease with fungicides, pesticides and herbicides creates pollution, biological imbalances and unforeseen dangers. Intensified animal production is also inconsistent with a stable agroecosystem since it creates concentrated accumulations of livestock manure which pollute water supplies instead of returning organic matter and nutrients to the depleting land resource.

Dr. Gordon MacEachern, President of the Agricultural Economics Research Council of Canada, said that we may have little to fear from over-expanded production. He said that Canada's competitive position in agriculture as in most other industries is suffering and that we might be squeezed out of export markets entirely. The survival of our agriculture-food industry is threatened, he said, because Canada is now a net importer of meat, fruits and vegetables, and two-thirds of our food imports are of commodities that are grown commercially in Canada. Among other factors, MacEachern blamed high wage rates, monetary-fiscal policy and protection of manufacturing industries for the poor productivity performance of Canada's agriculture-food industry.

Although physically possible, therefore, greatly expanded agricultural production may not be desirable from an ecological perspective, or feasible, given economic circumstances and trends. Furthermore, it may not even be desirable from the viewpoint of the world's hungry. Several speakers emphasized that a solution to hunger and poverty must be found within the affected countries, through a combination of better production, more equitable distribution and controlled population growth. Direct food shipments will continue to be important for isolated disasters and short-run emergencies, but the best assistance Canadians can give is technical. We can also stop consuming so much of the world's critical resources. This would mean less production than before.

<sup>1</sup>Dr. Keith Wilde, an economist with the Marketing and Trade Division, Economics Branch, Agriculture Canada, Ottawa, wrote this report for CFE.

The Royal Society of Canada and the Agricultural Institute of Canada sponsored this symposium at Carleton University, Ottawa, August 22-24, 1977.

Copies of the complete *Proceedings on Canada and World Food Symposium* are available from the Agricultural Institute of Canada, 151 Slater Street, Ottawa, Ontario, for \$8.00 per set including postage.

## SELF-SUFFICIENCY FOR UNDERDEVELOPED NATIONS

Given enough technological assistance and resources (mainly fuel), most countries could be self-sufficient in food production. According to Dr. W. David Hopper, President, International Development Research Centre, Ottawa, the most important obstacles to development are political, not physical or economic. He said that some Third World politicians have neglected agricultural development because an urban proletariat holds the key to their political survival. Employment in cities, cheap food and consumer goods have consequently been their chief preoccupation. They have been assisted in this by imports on concessional assistance terms (essentially free) from food-surplus countries. This free food has augmented the treasuries of recipient governments, but has been unfair competition for their farmers and has discouraged increased domestic production. Dr. Hopper said that too often food aid has been extended to relieve governments in the wealthy nations of the "costly embarrassments of the consequences of their own farm policies." Food aid should not be permitted to dull the sense of urgency in deficient countries for developing their own agriculture. He cited examples of developing countries which suggest that "a prospering rural population is an important if not vital stimulant to a buoyant national economy."

In advanced countries, one result of progressive agriculture is that fewer farmers are needed to meet food demand. Attrition in the number of farmers is widely lamented and overproduction is allowed. It is paid for, said Dr. Hopper, "by exploiting consumers through higher prices and taxpayers through direct farm subsidies." And the surplus food must be disposed of. "Food aid to developing nations seems humanitarian and useful as long as one does not look too closely."

Dr. Hopper gave examples which show that if developing countries make a concerted effort in agriculture, they can become formidable competitors with the food-surplus countries. Dr. Hopper said that Canada has not been overly cautious about helping potential competitors, but "if the aid that permits developing countries to purchase Canadian food and fertilizer materials is removed from the bilateral help the Canadian International Development Agency gives to developing nations, it is instructive to note how little of our assistance goes for agricultural and rural improvement activities. In 1974, it was only eleven percent."

The crucial issue to which all of this leads is that the total transformation of traditional agriculture, which

will be required if the Third World is to become self-sufficient in food, will be enormously expensive compared with the genetic research, pesticides, fertilizers, etc., that fueled the Green Revolution (which everyone admits to have been only a temporary solution). The necessary irrigation systems, transportation, markets, supply industries, storage and processing plants, etc., will cost billions — "amounts far beyond the ability of developing nations to squeeze from their own resources unless they have oil."

Hence massive sales of Canadian farm commodities at cost-covering prices are not a reliable prospect, and disposal of surplus commodities at subsidized prices is not a cost-effective way of assisting the hungry people of underdeveloped nations. Even fertilizer sales and assistance are questionable, according to speaker Graham Donaldson of the World Bank. The effectiveness of chemical fertilizers has been oversold, in his opinion, and transportation and distribution difficulties make nitrogen-fixing crops and animal manure more effective and reliable sources of essential nutrients. Technical assistance, expensive capital equipment and fuel seem to be the most effective gifts that Canada can bestow. There appears to be no way of giving real substance that is simultaneously needed by others and at the same time superfluous to us.

## DISTRIBUTION OF WEALTH

Dividing limited wealth is probably the oldest social problem according to Father J. Ogle of St. Francis Xavier Parish, Saskatoon. He said that unless there is more for everyone, an increase in one person's share decreases what is available to others. Economic growth is therefore everyone's favorite solution to the problem of distribution. But not only are there limits to growth, as previously noted by Dr. Shaw, adequate growth in the countries haunted by famine and despair seems contingent on a significant transfer of wealth from affluent nations.

Dr. C.F. Bentley, Soils Science Department, University of Alberta emphasized that welfare is not a right. He said that a human being is not entitled to any given standard of material welfare by the act of having been born. Effort is needed from everyone, even though the organization of sophisticated and rich societies makes it hard for individuals to see just how their own work is related to their share of the common wealth. Nevertheless, there is a temptation, especially in market-organized societies, for people to regard any compensation they receive for work or from commercial transactions as a

morally precise measure of what they deserve. Contrary to a frequently expressed belief, economic theorists have never given a justification for this attitude. And this applies to international as well as interpersonal and inter-class relations. Simply because rich countries pay for the resources they import from poorer ones does not make the transfer a morally fair exchange. Europe, North America and Japan consume an inordinate share of the world's natural resources, an increasing proportion of which comes from outside their own borders. If citizens of the market-oriented West come to live on the resources of the Third World, what can justify an enormous difference in affluence between the two regions? This question lies at the foundation of the OPEC petroleum cartel and the New Economic Order which Third World representatives have demanded at the United Nations.

## CHANGING OUR ATTITUDES

An important implication explicitly affirmed by several speakers, is that the hungry can be fed, but only if there are significant changes in attitudes and institutions in both the rich and the poor nations.

Dr. Lotta Hitschmanova of the Unitarian Service Committee maintains that mankind's greatest foe is hunger, but that few Canadians can empathize with this. It is therefore important to learn as a principle, that greed, resource exploitation and waste are sins. "Children must be taught that wasting food is a terrible affront to the starving." She said that not only must waste of food, water and electricity be eliminated, but that we must lower our consumption standards and expectations. If only armaments were given up, the resources released could solve the problem. Even if lower consumption and elimination of waste seem hard to justify, in a practical

sense, in affluent countries, they are necessary if there is to be a New Economic Order and they must be taught as principles.

Dr. Elmer L. Menzie, Head, Agricultural Economics and Extension, University of Guelph, endorsed this theme and suggested ways that governments can promote it. He said that too few resources are being used to inform the public about the conditions in developing countries and the objectives, methods, and results of our foreign assistance programs, and that too often our development efforts are not planned thoroughly enough. He criticized project scientists and managers who fail to ascertain carefully what the key questions are before throwing expensive resources into finding solutions. This is a basic fault in domestic as well as foreign programs, and is a waste we cannot afford. In concentrating on technical assistance and training for developing countries (of a kind that does most to improve the country's own productive capabilities), individuals and foundations should be encouraged by compensation and tax incentives to undertake development assignments. It is often not easy or pleasant work and deserving individuals merit adequate compensation.

Dr. Menzie, seconding the warning of Dr. MacEachern, emphasized that unless our own productive system becomes more efficient, we will have less to consume ourselves, and that will make us less able and willing to share. Labor, management and governments must accept a share of blame for our poor performance. "The world cannot afford the luxury of controlled or manipulated waste. . . . We must recognize above all, that our own efficiency in resource use, which is a major determinant of our own well-being, will be a crucial factor in the success or failure of efforts at economic development in Third World countries."

## PUBLICATIONS

*Publications are free unless otherwise noted.*

**Agriculture Statistics Yearbook 1976, Alberta Agriculture.** 1976. 85 p. *Available from the Statistics Branch, Alberta Agriculture, Edmonton, Alberta.*

**A Study of the Canadian Cattle Marketing System.** June 1977. 195 p. Paper cover. Tables. *Available from the Saskatchewan Wheat Pool, 2625 Victoria Avenue, Regina, Saskatchewan, S4P 2Y6.*

**Benefit-Cost Evaluation of Improved Levels of Agricultural Drainage in Manitoba – Vol. 1, Precipitation Excess of Agricultural Land – Vol. 2, Crop Damage Analysis – The Impact of Precipitation Excess – Vol. 3, Feasibility of Investment.** L.R. Rigaux and R.H. Singh. June 1977. 412 p. *Available from the Department of Agricultural Economics and Farm Management, Faculty of Agriculture, University of Manitoba, Winnipeg, R3T 2N2.*

**Commentary.** Vol. 31, Issue 5. October 1977. 4 p. *Available from the Cooperative Union of Canada, 111 Sparks Street, Ottawa, K1P 5B5.*

**Flue-Cured Tobacco Harvest Labor: Its Characteristics and Vulnerability to Mechanization.** D.M. Hoover and

L.B. Perkinson. June 1977. 132 p. *Available from North Carolina State University at Raleigh, Raleigh, North Carolina.*

**Grains and Oilseeds Marketing Incentives Program (GOMI).** 1977. 22 p. Bilingual. Paper cover. Catalogue No. C2-54/1977. *Available from Industry, Trade and Commerce, 112 Kent Street, Ottawa, K1A 0H5.*

**Grain Matters.** Newsletter. Sept.-Oct. 1977. 8 p. Figures, statistics, charts. *Available from the Canadian Wheat Board, 423 Main Street, Winnipeg, Manitoba, R3C 2P5.*

**Living with Climatic Change: Proceedings of a Seminar on Food and Climatic Change.** January 1977. 90 p. Tables, figures. Paper cover. Catalogue No. SS24-3/1977. *Available from the Science Council of Canada, 150 Kent Street, Ottawa, K1P 5P4.*

**Occupational Adjustment of Iowa Farm Operators Who Quit Farming, 1959-1961.** D.R. Kaldor and W.H. Edwards. March 1975. 46 p. Catalogue No. 75. *Available from the Department of Agriculture and Economics, Agriculture and Home Economics Experiment Station, Iowa State University of Science and Technology, Ames, Iowa.*

**Proceedings on Canada and World Food Symposium.** August 1977. *Available from the Agricultural Institute of Canada, 151 Slater Street, Ottawa. Price: \$8.00.*

## IN REPLY

*Note to Readers: We appreciate your letters and comments on articles in Canadian Farm Economics. Let us know if you think a subject deserves an article and we'll try to accomodate you.*

*When forwarding your 'In Reply' or letter, indicate if we may publish your comments in a subsequent issue.*

C.A. Gracey, Manager, Canadian Cattlemen's Association, says that G.E. Pugh did a first-rate job with his article "Instability in the World Beef Market" in our August issue, and he would like to see more work in this important area. Mr. Gracey also pointed out a discrepancy in the tables which the author resolved with him.

R.A. McGillivray, a farmer from Regina, also found the Pugh article very useful. He said this overview will be useful in his work with agricultural policy.

R.N. Plank, Assistant Regional Manager, Farm Credit Corporation, in British Columbia, would like to see an article on labor use in Canadian agriculture. He says that labor is reputedly scarce, affordable or considered to return less in agriculture than in other industries, and that all published estimates of labor-hours required for crops or livestock are out of date. Mr. Plank feels that such a study would "help in the planning of farm enterprises, in making expansion (or contraction) plans, and in determining efficiency of labour use", and help give a much needed definition to the 'family farm'. Mr. Plank says that the Landbouw Economisch Institut in the Netherlands has a labor requirement estimation program similar in principle to Canfarm's cash flow forecaster. "Data on manpower available, crop acreages, cow numbers and milking system are analyzed by a computer program and an estimate of labour required and labour available is printed out to show when short falls may occur." Mr. Plank believes that with some further research this method could be adapted for Canada.

**IN REPLY TO AUTHORS AND EDITORS REGARDING DECEMBER 1977  
CANADIAN FARM ECONOMICS**

I have read one or more of the following articles:

- (1) Japan-Canada's Leading Agricultural Export Market
- (2) Cow-calf Systems for the Maritime Provinces
- (3) Effective Farm Management

1. My comments are on article number (1) (2) (3).
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3. Why?

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My comments may ( ) may not ( ) be used in a future issue of this publication. (A copy of your comments will be forwarded to the author.)

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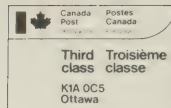


## CONVERSION FACTORS FOR METRIC SYSTEM

| Imperial units         | Approximate<br>conversion factor     | Results in:                          |
|------------------------|--------------------------------------|--------------------------------------|
| <b>LINEAR</b>          |                                      |                                      |
| inch                   | x 25                                 | millimetre (mm)                      |
| foot                   | x 30                                 | centimetre (cm)                      |
| yard                   | x 0.9                                | metre (m)                            |
| mile                   | x 1.6                                | kilometre (km)                       |
| <b>AREA</b>            |                                      |                                      |
| square inch            | x 6.5                                | square centimetre (cm <sup>2</sup> ) |
| square foot            | x 0.09                               | square metre (m <sup>2</sup> )       |
| acre                   | x 0.40                               | hectare (ha)                         |
| <b>VOLUME</b>          |                                      |                                      |
| cubic inch             | x 16                                 | cubic centimetre (cm <sup>3</sup> )  |
| cubic foot             | x 28                                 | cubic decimetre (dm <sup>3</sup> )   |
| cubic yard             | x 0.8                                | cubic metre (m <sup>3</sup> )        |
| fluid ounce            | x 28                                 | millilitre (ml)                      |
| pint                   | x 0.57                               | litre (ℓ)                            |
| quart                  | x 1.1                                | litre (ℓ)                            |
| gallon                 | x 4.5                                | litre (ℓ)                            |
| <b>WEIGHT</b>          |                                      |                                      |
| ounce                  | x 28                                 | gram (g)                             |
| pound                  | x 0.45                               | kilogram (kg)                        |
| short ton (2000 lb)    | x 0.9                                | tonne (t)                            |
| <b>TEMPERATURE</b>     |                                      |                                      |
| degrees Fahrenheit     | (° F-32) x 0.56<br>or (° F-32) x 5/9 | degrees Celsius (° C)                |
| <b>PRESSURE</b>        |                                      |                                      |
| pounds per square inch | x 6.9                                | kilopascal (kPa)                     |
| <b>POWER</b>           |                                      |                                      |
| horsepower             | x 746<br>x 0.75                      | watt (W)<br>kilowatt (kW)            |
| <b>SPEED</b>           |                                      |                                      |
| feet per second        | x 0.30                               | metres per second (m/s)              |
| miles per hour         | x 1.6                                | kilometres per hour (km/h)           |
| <b>AGRICULTURE</b>     |                                      |                                      |
| gallons per acre       | x 11.23                              | litres per hectare (ℓ/ha)            |
| quarts per acre        | x 2.8                                | litres per hectare (ℓ/ha)            |
| pints per acre         | x 1.4                                | litres per hectare (ℓ/ha)            |
| fluid ounces per acre  | x 70                                 | millilitres per hectare (ml/ha)      |
| tons per acre          | x 2.24                               | tonnes per hectare (t/ha)            |
| pounds per acre        | x 1.12                               | kilograms per hectare (kg/ha)        |
| ounces per acre        | x 70                                 | grams per hectare (g/ha)             |
| plants per acre        | x 2.47                               | plants per hectare (plants/ha)       |

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